

# Bījagaṇita of Bhāskara

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# I Introduction

## I.1 Text

This is a makeshift edition of Bhāskara's *Bījagaṇita* (hereafter BG). It consists of 102 Sanskrit verses for mathematical rules and 110 Sanskrit verses for examples and many of the former category and almost all of the latter are commented on by the author himself in Sanskrit prose. The work has been printed many times (see CESS, A4, 311b). The present edition is based on the latest seven printed books. They are as follows (in the alphabetical order of the abbreviations).

- A:** Acyutānanda Jhā's edition. Edited with Jīvanātha Jhā's Sanskrit commentary *Subodhinī* and the editor's own Sanskrit and Hindi commentaries. The manuscript(s) used is (are) not mentioned. Very close to Muralīdhara Jhā's edition (see 'M' below). Lacks Bhāskara's own commentary on the last example of Chapter 9 (BG E88p).
- F:** François Patte's critical edition of Sūryadāsa's commentary *Sūryaparakāśa* on the BG up to the kuṭṭaka section. Based on six manuscripts, but only two of them contain the BG itself (without the prose parts). Since the same two manuscripts are used also in Jain's edition (see 'J' below), I have not mentioned this edition in the critical apparatus except for one case (footnote for BG 32).
- G:** Girijāprasāda Dvivedī's edition of the BG together with the Sanskrit commentary *Vilāsi* and the Hindi Commentary *Mitākṣara* of his father Durgāprasāda Dvivedī. Several footnotes refer to variant readings of mūla- and ṭīkā-pustakas, although we cannot identify them.
- J:** Pushpa Kumari Jain's critical edition of Sūryadāsa's commentary *Sūryaparakāśa* on the BG up to the kuṭṭaka section. Based on twelve manuscripts (oldest of which is dated Saṃvat 1609 = AD 1552), but only three of them contain the BG itself (without the prose parts). See J(H), J(L) and J(S) in the 'Additional abbreviations' below.
- M:** Muralīdhara Jhā's re-edition of the text edited by Sudhākara Dvivedī (Benares 1888) with Sudhākara's and the editor's own mathematical comments in footnotes. Some of their comments refer to the text readings but all of them are meant for proposing better readings without documentation.
- P:** Poona edition of Kṛṣṇa's commentary *Bījapallava* (alias *Navāṅkra*) on the BG. Based on six manuscripts (oldest of which is dated Saṃvat 1761 = AD 1704) without critical apparatus. Does not contain the prose parts of the BG except for those quoted by Kṛṣṇa.
- T:** Tanjore edition of Kṛṣṇa's commentary *Bījapallava* (alias *Navāṅkra*) on the BG. Based on the oldest datable (11 April 1601 Julian) manuscript of the commentary. Only three footnotes (on pp. 2, 3, and 8) refer to the readings of the

manuscript. The corrigenda (śuddhāśuddha-patrikā), printed on the five pages that precede the text, may include corrections not only of printing errors but also of errors in the manuscript. Does not contain the prose parts of the BG except for those quoted by Kṛṣṇa.

Out of these, only A, G, and M contain both metrical and prose parts; the other four editions contain only the metrical parts.

## I.2 Abbreviations

In addition to those defined in the previous section, I use the following abbreviations.

**BSS:** *Brāhmasphuṭasiddhānta* of Brahmagupta.

**C:** Colebrooke's English translation of the BG.

**CV:** Vṛddhacāṇakya, textus ornatior version.

**GA:** *Golādhyāya* of Bhāskara.

**J(H):** British Museum manuscript 447 used for J. 19th century.

**J(L):** Akhila Bhāratīya Saṃskṛta Pariṣad (Lucknow) manuscript, 4514, used for J (the BG verses are available up to BG 21). Dated Saṃvat 1745 = AD 1688.

**J(S):** British Museum manuscript 448 used for J. 19th century.

**L:** *Līlāvātī* of Bhāskara.

**L(ASS):** Ānandāśrama edition of the L.

**L(VIS):** Hoshiarpur edition of the L.

**P(K):** Prose part of the BG cited by Kṛṣṇa in P.

**PPM(Wai):** Prājña Pāṭhaśālā Maṇḍala, Wai.

**SS:** *Siddhāntaśiromaṇi* of Bhāskara.

**SSe:** *Siddhāntaśekhara* of Śrīpati.

**T(cor):** Corrigenda (śuddhāśuddhapatrikā) of T.

**T(K):** Prose part of the BG cited by Kṛṣṇa in T.

**T(Ms):** Tanjore manuscript D 11523 used for T.

## I.3 Notation

**BG  $n$ :** the  $n$ -th verse for mathematical rules of the BG. I do not mention 'BG' when there is no fear of confusion, in this and the next three cases.

**BG  $En$ :** the  $n$ -th verse for examples of the BG.

**BG  $Qn$ :** the  $n$ -th quoted verse in the prose auto-commentary of the BG.

**BG  $np/Enp$ :** the prose commentary that occurs immediately after verse  $n/En$ . I divide it in paragraphs with serial numbers ( $np1$ ,  $np2$ , etc.) when appropriate.  $np0/Enp0$  denotes the introductory paragraph for verse  $n/En$  or for verses beginning with  $n/En$ .

$\square$ : enclosure for displayed numerical expressions. It is commonly used in Sanskrit

mathematical manuscripts, especially when the numerical expressions have more than one line, although it is not used in AMG.

$\langle x \rangle$ :  $x$  was added by me. This notation is not used for the chapter headings and the section headings, all of which were supplied by me.

$x$  T1 ]  $y$  T2: the text T2 reads  $y$  for  $x$  of the text T1 which is accepted in the present edition.

$\emptyset$  : non-existence.

#### I.4 Publishing Information

- A:** *The Bījagaṇita: Elements of Algebra of Śrī Bhāskarācārya*, edited and compiled with the *Subodhinī* Sanskrit Commentary of Jīvanātha Jhā and the *Vimalā* Exhaustive Sanskrit & Hindi commentaries, Notes, Exercices, Proofs, etc. by Acyuthānanda Jhā. Kashi Sanskrit Series 148. Benares: Chowkhamba Sanskrit Office, 1949.
- BSS:** *Brāhmasphuṭasiddhānta* of Brahmagupta, edited with the editor's own commentary in Sanskrit by Sudhākara Dvivedī. Benares: Medical Hall Press, 1902.
- C:** *Algebra with Arithmetic and Mensuration from the Sanscrit of Brahmagupta and Bha'scara*, by Henry Thomas Colebrooke. London: John Murray, 1817. Reprinted under the title, *Classics of Indian Mathematics*, with a foreword by S. R. Sarma. Delhi: Sharada Publishing House, 2005.
- CESS:** *Census of the Exact Sciences in Sanskrit*, by David Pingree. Ser. A, 5 vols. Memoire of the American Philosophical Society 81, 86, 111, 146, and 213. Philadelphia: American Philosophical Society, 1970, 71, 76, 81, and 94.
- CNTT:** *Cāṇakya-Nīti-Text-Tradition*, by Ludwik Sternbach, 2 vols. in 5 pts., Vishveshvaranand Indological Series 2 and 29, Hoshiarpur: Vishveshvaranand Vedic Research Institute, 1963–70.
- CV:** 'Vṛddha-Cāṇakya: Textus Ornatiore Version,' CNTT vol. 1, pt. 1, pp. 1–104.
- F:** *Le Siddhāntaśiromaṇi I-II: Édition, traduction et commentaire*, par François Patte avec une préface de Pierre-Sylvain Filliozat. Hautes Études Orientales 38. Volume I: Text et Volume II: Traduction. Genève: Librairie Droz, 2004.
- G:** *Bījagaṇitam*, edited with Durgāprasāda Dvivedī's Sanskrit and Hindi commentaries by Girijāprasāda Dvivedī. 3rd ed. Lakṣmaṇapura: Kesarīdās Seṭh, 1941.
- GA:** See 'SS' below.
- J:** *The Sūryapraśāsa of Sūryadāsa: A Commentary on Bhāskarācārya's Bījagaṇita, Volume 1: A Critical Edition, English Translation and Commentary for the Chapters, Upodghāta, Śaḍvidhāprakarāṇa and Kuṭṭakādhikāra*, by Pushpa Kumari Jain. Gaekwad's Oriental Series 182. Vadodara: Oriental Institute, 2001.
- L(AS):** *Līlāvātī* of Bhāskara, edited with Gaṇeśa's *Buddhivilāsinī* and Mahīdhara's *Līlāvātīvivaraṇa* by Dattātreya Āpaṭe, et al. Ānandāśrama Sanskrit Series 107, 2 vols. Poona: Ānandāśrama Press, 1937.

- L(VIS):** *Līlavatī* of Bhāskara, edited with Śaṅkara and Nārāyaṇa's *Kriyākramakarī* by K. V. Sarma. Vishveshvaranand Indological Series 66, Hoshiarpur: Vishveshvaranand Vedic Research Institute, 1975.
- M:** *Bījagaṇita: Elements of Algebra of Śrī Bhāskarācārya, with Expository Notes and Illustrative Examples* by M. M. Pandit Śrī Sudhākara Dvivedī, ed. with further notes by Mahāmahopadhyāya Pandit Śrī Muralīdhara Jhā. Benares Sanskrit Series 159. Benares: Krishna Das Gupta, 1927.
- P:** *Bhāskrarīya-bījagaṇitam*, edited with Kṛṣṇa's *Navāṅkura* by Dattātreyā Āpaṭe, et al. Ānandāśrama Sanskrit Series 99. Poona: Ānandāśrama Press, 1930.
- SS:** *Siddhāntaśiromaṇi of Bhāskarācārya*, edited with the auto-commentary *Vāsanābhāṣya* and *Vārtika* of Nṛsiṃha Daivajña by Murali Dhara Chaturvedi. Library Rare Text Publication Series 5. Varanasi: Sampurnanand Sanskrit University, 1981.
- SSe:** *Siddhāntaśekhara* of Śrīpati, edited with Makkibhaṭṭa's *Gaṇitabhūṣana* and the editor's *vivarāṇa* by Babuāji Miśra. 2 parts. Calcutta: University of Calcutta, 1932/47.
- T:** *Bījapallavam: A Commentary on Bījagaṇita, the Algebra in Sanskrit*, edited with Preface by T. V. Radhakrishna Sastri. Madras Government Oriental Series 67 (Tanjore Saraswathi Mahal Series 78). Tanjore: TMSSM Library, 1958.

## II Bījagaṇita

### II.1 Dhanarṇa-ṣaḍvidha

utpādakaṃ yat pravadanti buddher 1  
adhiṣṭhitaṃ satpuruṣeṇa sām̐khyāḥ/  
vyaktasya kṛtsnasya tad ekabījam  
avyaktam īśaṃ gaṇitaṃ ca vande//1//

pūrvam proktaṃ vyaktam avyaktabījam 2  
prāyaḥ praśnā no vināvyaktayuktyā/  
jñātum śakyā mandadhībhir nitāntam  
yasmāt tasmād vacmi bījakriyām ca//2//<sup>1</sup>

dhanarṇasaṃkalane karaṇasūtraṃ vṛttārdham/3abp0/

yoge yutiḥ syāt kṣayayoḥ svayor vā 3ab  
dhanarṇayor antaram eva yogah/3ab/<sup>2</sup>

udāharaṇam/E1p0/

rūpatrayam rūpacatuṣṭayam ca 81  
kṣayam dhanam vā sahitaṃ vadāśu/  
svarṇam kṣayasvam ca pṛthak pṛthak ced  
dhanarṇayoḥ saṃkalanām avaiṣi//E1//<sup>3</sup>

atra rūpāṇām avyaktānām cādyākṣarāṇy upalakṣaṇārthaṃ lekhyāni/ tathā yāny  
ṛṇagatāni tāny ūrdhvaḥbindūni ca/ nyāsaḥ/ rū 3̣ rū 4̣/ yoge jātam rū 7̣/ nyāsaḥ/ rū  
3̣ rū 4̣/ yoge jātam rū 7̣/ nyāsaḥ/ rū 3̣ rū 4̣/ yoge jātam rū 1̣/ nyāsaḥ/ rū 3̣ rū 4̣/  
yoge jātam rū 1// evaṃ bhinneṣv api//E1p//<sup>4</sup>

dhanarṇavyavakalane karaṇasūtraṃ vṛttārdham/3cdp0/

saṃśodhyamānam svam ṛṇatvam eti 3cd

<sup>1</sup>vyaktam AMGTPJJ(HL) ] vyaktām J(S); praśnā no AMGTPJJ(HS) ] praśnānno J(L); śakyā  
manda AMGTPJJ(HS) ] śattyāmīda J(L).

<sup>2</sup>syāt kṣayayoḥ AMGTPJJ(LS) ] tkṣayayoḥ J(H).

<sup>3</sup>kṣayasvam JJ(L) ] kṣayam svam AMG, kṣayaḥ svam TPJ(HS); pṛthak ced J(HS) ] pṛthāṇme  
AGMTJJ(L), pṛthaktve P.

<sup>4</sup>nyāsaḥ/ (2nd, 3rd, 4th) G ] ” AM; jātam (1st) G ] jātam A, jāta M; rū 7̣ AM ] rū 7 G; yoge jātam  
(2nd, 3rd, 4th) G ] ” AM; bhinneṣv api// AM ] bhinneṣvapi iti dhanarṇasaṃkalanā/ G.

svatvaṃ kṣayas tadyutir uktavac ca//3cd//

udāharaṇam/E2abp0/

trayād dvayaṃ svāt svam ṛṇād ṛṇaṃ ca  
vyastam ca saṃśodhya vadāśu śeṣam/E2ab/

E2ab

nyāsaḥ/ rū 3 rū 2/ antare jātam rū 1/ nyāsaḥ/ rū 3<sup>•</sup> rū 2<sup>•</sup>/ antare jātam rū  
1<sup>•</sup>/ nyāsaḥ/ rū 3 rū 2<sup>•</sup>/ antare jātam rū 5/ nyāsaḥ/ rū 3<sup>•</sup> rū 2<sup>•</sup>/ antare jātam rū  
5<sup>•</sup>//E2abp1//<sup>5</sup>

iti dhanarṇasaṃkalanavyavakalane//E2abp2//<sup>6</sup>  
guṇane bhāgahāre ca karaṇasūtram vṛttārdham/4abp0/<sup>7</sup>

svayor asvayoh svam vadhaḥ svarṇaghāte  
kṣayo bhāgahāre 'pi caivaṃ niruktam/4ab/<sup>8</sup>

4ab

udāharaṇam/E2cdp0/

dhanam dhanenarṇam ṛṇena nighnam  
dvayaṃ trayeṇa svam ṛṇena kiṃ syāt//E2cd//<sup>9</sup>

E2cd

nyāsaḥ/ rū 2 rū 3/ dhanam dhanagham dhanam syād iti jātam rū 6/ nyāsaḥ/  
rū 2 rū 3/ ṛṇam ṛṇagham dhanam syād iti jātam rū 6/ nyāsaḥ/ rū 2 rū 3/ dhanam  
ṛṇagham ṛṇam syād iti jātam rū 6/ nyāsaḥ/ rū 2 rū 3/ ṛṇam dhanagham ṛṇam  
syād iti jātam rū 6//E2cdp1//<sup>10</sup>

iti dhanarṇaguṇanam//E2cdp2//  
udāharaṇam/E3p0/

rūpāṣṭakam rūpacatuṣṭayena  
dhanam dhanenarṇam ṛṇena bhaktam/  
ṛṇam dhanena svam ṛṇena kiṃ syād

E3

<sup>5</sup>nyāsaḥ/ (2nd, 3rd, 4th) G ] ” AM; antare jātam (2nd, 3rd, 4th) G ] ” AM.

<sup>6</sup>dhanarṇasaṃkalanavyavakalane AM ] dhanarṇavyavakalanam G.

<sup>7</sup>bhāgahāre ca ] ∅ AMGTPJ.

<sup>8</sup>vadhaḥ AMGTPJ(HLS) ] vadhe J; GTP place ‘bhāgahāre ‘pi caivaṃ niruktam’ after E2cdp2.

<sup>9</sup>dhanam AMGTPJJ(LS) ] dhane J(H).

<sup>10</sup>nyāsaḥ/ (2nd, 3rd, 4th) G ] ” AM; syād iti jātam (2nd, 3rd, 4th) G ] ” AM; rū 2 (2nd) AG ] rū  
2 M.

**drutaṃ vadedam̐ yadi bobudhīṣi//E3//<sup>11</sup>**

nyāsaḥ/ rū 8 rū 4/ dhanam̐ dhanahr̥tam̐ dhanam̐ syād iti jātam̐ rū 2/ nyāsaḥ/  
rū 8 rū 4/ ṛṇam̐ ṛṇahr̥tam̐ dhanam̐ syād iti jātam̐ rū 2/ nyāsaḥ/ rū 8 rū 4/ ṛṇam̐  
dhanahr̥tam̐ ṛṇam̐ syād iti jātam̐ rū 2/ nyāsaḥ/ rū 8 rū 4/ dhanam̐ ṛṇahr̥tam̐ ṛṇam̐  
syād iti jātam̐ rū 2//E3p1//<sup>12</sup>

iti dhanarṇabhāgahārah//E3p2//

varge mūle ca karaṇasūtram̐ vṛttārdham/4cdp0/<sup>13</sup>

**kr̥tiḥ svarṇayoḥ svam̐ svamūle dhanarṇe/  
na mūlam̐ kṣayasyāsti tasyākṛtitvāt//4cd//<sup>14</sup>**

4cd

vargodāharaṇam/E4abp0/<sup>15</sup>

**dhanasya rūpatritayasya vargam̐  
kṣayasya ca brūhi sakhe mamāśu/E4ab//<sup>16</sup>**

E4ab

nyāsaḥ/ rū 3 rū 3/ jātau vargau rū 9/ rū 9//E4abp//  
mūlodāharaṇam/E4cdp0/<sup>17</sup>

**dhanātmakānām adhanātmakānām  
mūlam̐ navānām ca pṛthag vadāśu//E4cd//**

E4cd

nyāsaḥ/ rū 9/ mūlam̐ rū 3 vā rū 3/ nyāsaḥ/ rū 9/ eṣām avargatvān mūlam̐  
nāsti//E4cdp1//<sup>18</sup>

iti vargamūle//E4cdp2//<sup>19</sup>

iti dhanarṇaṣaḍvidham//E4cdp3//

<sup>11</sup>syād drutaṃ AMGTPJJ(H) ] syādṛtam̐ J(L), syādrutaṃ J(S).

<sup>12</sup>nyāsaḥ/ (2nd, 3rd, 4th) G ] ” AM; dhanam̐ syād iti jātam̐ (2nd) G ] ” AM; ṛṇam̐ syād iti jātam̐ (2nd) G ] ” AM.

<sup>13</sup>varge mūle ca AMTP ] vargādaḥ G.

<sup>14</sup>svaṛṇayoḥ AMGPJ ] svaṛṇagoḥ T; tasyākṛtitvāt GTPJ ] tasyā kṛtitvāt AM.

<sup>15</sup>vargodāharaṇam̐ AM ] udāharaṇam̐ G.

<sup>16</sup>vargam̐ AMGPJ ] varge T.

<sup>17</sup>mūlodāharaṇam̐ AM ] udāharaṇam̐ G.

<sup>18</sup>rū 3 vā rū 3 AM ] 3 vā 3 G; nyāsaḥ/ (2nd) G ] ” AM.

<sup>19</sup>vargamūle AM ] dhanarṇavargamūle G.



## II.2 Kha-ṣaḍvidha

khasaṃkalanavyavakalane karaṇasūtram vṛttārdham/5abp0/

**khayoge viyoge dhanarṇaṃ tathaiva** 5ab  
**cyutaṃ sūnyatas tad viparyāsam eti/5ab/**<sup>20</sup>

udāharaṇam/E5abp0/

**rūpatrayaṃ svaṃ kṣayagaṃ ca khaṃ ca** E5ab  
**kiṃ syāt khayuktaṃ vada khāc cyutaṃ ca/E5ab/**<sup>21</sup>

nyāsaḥ/ rū 3 rū ३̣ rū 0/ etāni khayutāny avikṛtāny eva/ nyāsaḥ/ rū 3 rū ३̣ rū 0/  
etāni khāc cyutāni rū ३̣ rū 3 rū 0//E5abp1//<sup>22</sup>  
iti khasaṃkalanavyavakalane//E5abp2//  
khaguṇādiṣu karaṇasūtram vṛttārdham/5cdp0//<sup>23</sup>

**vadhādaḥ viyat khasya khaṃ khena ghāte** 5cd  
**khahāro bhavet khena bhaktaś ca rāśiḥ//5cd//**

udāharaṇam/E5cdp0/

**dvighnaṃ trihṛt khaṃ khahrtaṃ trayam ca** E5cd  
**sūnyasya vargaṃ vada me padaṃ ca//E5cd//**<sup>24</sup>

nyāsaḥ/ guṇyaḥ rū 0 guṇakaḥ rū 2 guṇite jātam rū 0/ nyāsaḥ/ bhājyaḥ rū 0  
bhājakaḥ rū 3 bhakte jātam rū 0/ nyāsaḥ/ bhājyaḥ rū 3 bhājakaḥ rū 0 bhakte jātam  
rū ३̣ / ayam ananto rāśiḥ khahara ity ucyate//E5cdp1//<sup>25</sup>

**asmin vikāraḥ khahare na rāśāv** 6

<sup>20</sup>dhanarṇaṃ AMGPJ ] dhanarṇe T.

<sup>21</sup>khāc cyutaṃ AM ] khacyutaṃ GTPJ. The commentator Kṛṣṇa accepts ‘khacyutaṃ’ but in P refers to ‘khāc cyutaṃ’ as a variant. The editor of G, too, accepts ‘khacyutaṃ’ but remarks that many manuscripts read ‘khāc cyutaṃ’.

<sup>22</sup>nyāsaḥ/ (2nd) G ] ∅ AM.

<sup>23</sup>guṇādiṣu AM ] guṇanādiṣu G.

<sup>24</sup>vargaṃ AMGTPJJ(HL) ] varge J(S).

<sup>25</sup>nyāsaḥ/ (2nd, 3rd) G ] ” AM; jātam (2nd, 3rd) G ] ” AM; bhājyaḥ (2nd) G ] ” AM; bhakte (2nd) G ] ” AM; rū ३̣ / ayam ananto rāśiḥ ] rū ३̣ / ayamananto ३̣ rāśiḥ A, rū 0 3/ ayamananto rāśiḥ M, rū ३̣ ayamananto rāśiḥ G.

api praviṣṭeṣv api nissrṭeṣu/  
 bahuṣv api syāl layasrṣṭikāle  
 'nante 'cyute bhūtagaṇeṣu yadvat//6//<sup>26</sup>

nyāsaḥ/ rū 0/ asya vargaḥ rū 0/ mūlam rū 0//E5cdp2//  
 evaṃ khaguṇādi//E5cdp3//<sup>27</sup>  
 iti khaṣaḍvidham//E5cdp4//

### II.3 Avyakta-ṣaḍvidha<sup>28</sup>

#### II.3.1 Avyakta-ṣaḍvidha

athāvyaktakalpanā/7p0/<sup>29</sup>

yāvattāvat kālako nīlako 'nyo 7  
 varṇaḥ pīto lohitaś caitadādyāḥ/  
 avyaktānām kalpitā mānasamjñās  
 tatsamkhyānam kartum ācāryavaryaiḥ//7//<sup>30</sup>

avyaktasamkalanavyavakalane karaṇasūtram vṛttārdham/8abp0/

yogo 'ntaram teṣu samānajātyor 8ab  
 vibhinnaajātyoś ca pṛthaksthitīś ca//8ab//<sup>31</sup>

udāharaṇam/E6p0/

svam avyaktam ekaṃ sakhe saikarūpaṃ E6  
 dhanāvyaktayugmaṃ virūpāṣṭakaṃ ca/  
 yutau pakṣayor etayoḥ kiṃ dhanarṇe  
 viparyasya caikyē bhavet kiṃ vadāśu//E6//<sup>32</sup>

<sup>26</sup>khahare na AMGTJJ(HS) ] khahareṇa PJ(L); 'nante AMGPJJ(HL) ] 'namte T, 'nata J(S).

<sup>27</sup>khaguṇādi M ] khaghanādi AG.

<sup>28</sup>I divide this chapter in two sections, avyakta-ṣaḍvidha and anekavarṇa-ṣaḍvidha, according to the concluding remarks 12p3 and E10p7. But it should be noted that the rules in this chapter are all given in the first section and that the second section consists only of examples for the second category.

<sup>29</sup>athāvyaktakalpanā AM ] ∅ G.

<sup>30</sup>māna AMGPJ ] nāma T.

<sup>31</sup>sthitīś ca AMGTPJ ] sthitiḥ syāt, a variant mentioned by Kṛṣṇa.

<sup>32</sup>svam AMGPJ ] kham T; saikarūpaṃ AMGPJ ] caikarūpaṃ T; pakṣayor AMGTPJJ(HS) ] pakṣayar J(L); kiṃ (1st) MGTPJ ] ki A. J(L) places E6 after E7ab.

nyāsaḥ/ yā 1 rū 1/ yā 2 rū 8/ anayor yoge jātām yā 3 rū 7/ ādyapakṣasya dhana-  
 rṇavyatyāse nyāsaḥ/ yā 1 rū 1/ yā 2 rū 8/ yoge 'nayor jātām yā 1 rū 9/ dvitīyasya  
 vyatyāse nyāsaḥ/ yā 1 rū 1/ yā 2 rū 8/ yoge jātām yā 1 rū 9/ ubhayor vyatyāse  
 nyāsaḥ/ yā 1 rū 1/ yā 2 rū 8/ yoge jātām yā 3 rū 7//E6p//<sup>33</sup>  
 anyad udāharaṇam/E7abp0/<sup>34</sup>

**dhanāvyaktavargatrayaṃ satrirūpaṃ**

E7ab

**kṣayāvyaktayugmena yuktaṃ ca kiṃ syāt//E7ab//<sup>35</sup>**

nyāsaḥ/ yāva 3 rū 3/ yā 2/ yoge jātām yāva 3 yā 2 rū 3//E7abp//  
 anyad udāharaṇam/E7cdp0/<sup>36</sup>

**dhanāvyaktayugmād ṛṇāvyakṣaṭkaṃ**

E7cd

**sarūpāṣṭakaṃ projjhya śeṣaṃ vadāsu//E7cd//<sup>37</sup>**

nyāsaḥ/ yā 2/ yā 6 rū 8/ śodhite jātām yā 8 rū 8//E7cdp1//  
 ity avyaktasaṃkalanavyavakalane//E7cdp2//  
 avyaktādiguṇane karaṇasūtraṃ sārḍhavr̥ttadvayam/8cdp0/

**syād rūpavarṇābhīhatau tu varṇo**

8cd

**dvitryādikānāṃ samajātikānāṃ//8cd//<sup>38</sup>**

**vadhe tu tadvargaghanādayaḥ syus**

9

**tadbhāvitam cāsamajātighāte/**

**bhāgādikaṃ rūpavad eva śeṣaṃ**

**vyakte yad uktaṃ gaṇite tad atra//9//<sup>39</sup>**

**guṇyaḥ pṛthag guṇakakhaṇḍasamo niveśyas**

10

**taiḥ khaṇḍakaiḥ kramahataḥ sahito yathoktyā/**

**avyaktavargakaraṇīguṇanāsu cintyo**

**vyaktoktakhaṇḍaguṇanāvidhir evam atra//10//<sup>40</sup>**

<sup>33</sup>yoge 'nayor AM ] anayoryoge G.

<sup>34</sup>anyad AM ] ∅ G.

<sup>35</sup>dhanāvyakta MGTPJ ] dhanāavyakta A.

<sup>36</sup>anyad udāharaṇam/ A ] ∅ MG.

<sup>37</sup>dhanāvyakta AMGTPJJ(HS) ] dhanavyakta J(L); projjhya AMP ] projhya G, prokta T, prohya J.

<sup>38</sup>varṇo MGTPJJ(H) ] varṇau AJ(LS).

<sup>39</sup>cāsama AMGPJ ] syātsama T; vyakte AGTPJ ] vyakta M.

<sup>40</sup>pṛthag guṇaka AMGPJ ] pṛthakpṛthagguṇa T; niveśyas taiḥ AMGPJ ] niveśya taiḥ tair T.

udāharaṇam/E8p0/

**yāvattāvatpañcakaṃ vyekarūpaṃ**  
**yāvattāvadbhis tribhiḥ sadvirūpaiḥ/**  
**saṃguṇya drāg brūhi guṇyaṃ guṇaṃ vā**  
**vyastaṃ svarṇaṃ kalpayitvā ca vidvan//E8//<sup>41</sup>**

E8

nyāsaḥ/ guṇyaḥ yā 5 rū 1/ guṇakaḥ yā 3 rū 2/ guṇanāj jātama phalam yāva 15  
yā 7 rū 2/ guṇyasya dhanarṇatvavyatyāse nyāsaḥ/ guṇyaḥ yā 5 rū 1/ guṇakaḥ yā  
3 rū 2/ guṇanāj jātama yāva 15 yā 7 rū 2/ guṇakasya dhanarṇatvavyatyāse nyāsaḥ/  
guṇyaḥ yā 5 rū 1/ guṇakaḥ yā 3 rū 2/ guṇanāj jātama yāva 15 yā 7 rū 2/ dvayora  
dhanarṇatvavyatyāse nyāsaḥ/ guṇyaḥ yā 5 rū 1/ guṇakaḥ yā 3 rū 2/ guṇanāj jātama  
yāva 15 yā 7 rū 2//E8p//<sup>42</sup>

bhāgahāre karaṇasūtraṃ vṛttam/11p0/

**bhājyāc chedaḥ śudhyati pracyutaḥ san**  
**sveṣu sveṣu sthānakeṣu krameṇa/**  
**yair yair varṇaiḥ saṃguṇo yaiś ca rūpair**  
**bhāgahāre labdhayas tāḥ syur atra//11//<sup>43</sup>**

11

pūrvaguṇanaphalasya svaguṇacchedasya prathamapakṣasya bhāgahārārtham  
nyāsaḥ/ bhājyaḥ yāva 15 yā 7 rū 2/ bhājakaḥ yā 3 rū 2/ bhajanād āpto guṇyaḥ  
yā 5 rū 1/ dvitīyasya nyāsaḥ/ bhājyaḥ yāva 15 yā 7 rū 2/ bhājakaḥ yā 3 rū 2/  
bhajanena labdho guṇyaḥ yā 5 rū 1/ tṛtīyasya nyāsaḥ/ bhājyaḥ yāva 15 yā 7 rū 2/  
haraḥ yā 3 rū 2/ haraṇād āpto guṇyaḥ yā 5 rū 1/ caturthasya nyāsaḥ/ bhājyaḥ yāva  
15 yā 7 rū 2/ haraḥ yā 3 rū 2/ hrte labdho guṇyaḥ yā 5 rū 1//11p1//<sup>44</sup>

ity avyaktaguṇanabhajane//11p2//

vargodāharaṇam/E8efp0/

<sup>41</sup>tribhiḥ AMGPJ ] tribhiḥ T; saṃguṇya AMGPJ ] saṃguṇyaṃ T; brūhi MGTPJ ] brahi A;  
guṇyaṃ guṇaṃ AMGTPJ ] guṇye guṇe, a variant mentioned by Kṛṣṇa; vyastaṃ svarṇaṃ AMGTPJ  
] vyastavarṇaṃ, a variant mentioned by Kṛṣṇa; kalpayitvā AMGTPJJ(HS) ] kalpitvā J(L); ca  
GTPJ(S) ] tu AMJJ(HL).

<sup>42</sup>yā 5 (2nd) AG ] yā 2 M.

<sup>43</sup>san sveṣu AMGTPJJ(L) ] santsveṣu J(H), san J(S); saṃguṇo AMGTPJJ(HL) ] saṃguṇair J(S);  
bhāgahāre AMGPJ ] bhāgahāre T.

<sup>44</sup>pūrvā AG ] pūva M; prathamapakṣasya bhāgahārārtham AG ] bhāgahārārtha prathamapakṣasya  
M; bhājakaḥ (2nd) AG ] ∅ M; haraḥ yā (twice) AM ] bhājakaḥ/ yā G; rū 2 (4th) AG ] rū 2 M; yā  
5 (2nd) A ] yā 5 MG.

**rūpaiḥ ṣaḍbhir varjitānām caturṇām**  
**avyaktānām brūhi vargaṃ sakhe me//E8ef//<sup>45</sup>**

E8ef

nyāsaḥ/ yā 4 rū 6/ jāto vargaḥ yāva 16 yā 48 rū 36//E8efp//<sup>46</sup>

**kr̥tibhya ādāya padāni teṣām**  
**dvayor dvayoś cābhihatim̐ dvinighnīm/**  
**śeṣāt tyajed rūpapadaṃ gṛhītvā**  
**cet santi rūpāni tathaiva śeṣam//12//<sup>47</sup>**

12

pūrvasiddhavargasya mūlārthaṃ nyāsaḥ/ yāva 16 yā 48 rū 36/ labdhaṃ mūlam  
yā 4 rū 6//12p1//<sup>48</sup>

ity avyaktavargamūle//12p2//<sup>49</sup>

ity avyaktaṣaḍvidham//12p3//

### II.3.2 Anekavarṇa-ṣaḍvidha

athānekavarṇaṣaḍvidham//E9p1//

tatra saṃkalanavyavakalanodāharaṇam/E9p0//<sup>50</sup>

**yāvattāvatkālakānīlakavarṇās tripañcasaptadhanam/**  
**dvitryekamitaiḥ kṣayagaiḥ sahitā rahitāḥ kati syus taiḥ//E9//<sup>51</sup>**

E9

nyāsaḥ/ yā 3 kā 5 nī 7/ yā 2 kā 3 nī 1/ yoge jātam yā 1 kā 2 nī 6/ viyoge jātam  
yā 5 kā 8 nī 8//E9p1//

ity anekavarṇasaṃkalanavyavakalane//E9p2//

guṇanāder udāharaṇam/E10p0/

**yāvattāvattrayam ṛṇam ṛṇam kālakau nīlakaḥ svam̐**  
**rūpeṇādhyā dvigūṇitamitais te tu tair eva nighnāḥ/**

E10

<sup>45</sup>rūpaiḥ AMGPJ ] rūpai T.

<sup>46</sup>yā 4 AG ] yā 3 M.

<sup>47</sup>rūpapadaṃ MGTPJ ] rupapadaṃ A; tathaiva śeṣam AMGTPJJ(HS) ] padāni caivam J(L).

<sup>48</sup>siddha AM ] siddhasya G.

<sup>49</sup>vargamūle AM ] vargavargamūle G.

<sup>50</sup>vyavakalanodāharaṇam AM ] vyavakalanayorudāharaṇam G.

<sup>51</sup>kālaka AMGTPJJ(HL) ] kāla J(S); rahitāḥ AMGPJ ] rahitā T; syus taiḥ AMGTPJ(S) ] syuste JJ(HL).

kiṃ syāt teṣāṃ guṇanajaphalaṃ guṇyabhaktaṃ ca kiṃ syād  
guṇyasyātha prakathaya kṛtiṃ mūlam asyāḥ kṛteś ca//E10//<sup>52</sup>

nyāsaḥ/ guṇyaḥ yā 3 kā 2 nī 1 rū 1/ guṇakaḥ yā 6 kā 4 nī 2 rū 2/ guṇite jātā yāva  
18 kāva 8 nīva 2 yākābhā 24 yānībhā 12 kānībhā 8 yā 12 kā 8 nī 4 rū 2//E10p1//<sup>53</sup>  
asmād eva guṇanaphalād guṇyenānena yā 3 kā 2 nī 1 rū 1 bhaktād āpto guṇakaḥ  
yā 6 kā 4 nī 2 rū 2//E10p2//  
ity anekavarṇaguṇanabhajane//E10p3//  
pūrvaguṇyasya vargārthaṃ nyāsaḥ/ yā 3 kā 2 nī 1 rū 1/ jāto vargaḥ yāva 9 kāva  
4 nīva 1 yākābhā 12 yānībhā 6 kānībhā 4 yā 6 kā 4 nī 2 rū 1//E10p4//  
vargād asmān mūlam yā 3 kā 2 nī 1 rū 1//E10p5//<sup>54</sup>  
ity anekavarṇavargavargamūle//E10p6//<sup>55</sup>  
ity anekavarṇaśaḍvidham//E10p7//

## II.4 Karaṇī-śaḍvidha

atha karaṇīśaḍvidham//13p1//

tatra saṃkalanavyavakalanayoḥ karaṇasūtraṃ vṛttadvayam/13p0/

yogaṃ karaṇyora mahatīm prakalpya 13  
ghātasya mūlaṃ dviguṇaṃ laghuṃ ca/  
yogāntare rūpavad etayoḥ sto  
vargeṇa vargaṃ guṇayed bhajec ca//13//<sup>56</sup>  
laghvyā hṛtāyās tu padaṃ mahatyāḥ 14  
saikaṃ nirekaṃ svahataṃ laghughnam/  
yogāntare staḥ kramaśas tayora vā  
pṛthaksthitih syād yadi nāsti mūlam//14//<sup>57</sup>

udāharaṇam/E11p0/

<sup>52</sup>tāvattrayam AMGPJ ] tāvatrayam T; kālakaḥ AMGTPJJ(LS) ] kālako J(H); rūpeṇāḍhyā AMGPJ ] rūpeṇādyād T; dviguṇitamitais te AMGTJJ(H) ] dviguṇitamitaistais P, dviguṇamitaiste J(L), dviguṇitamiteste J(S); asyāḥ AMGPJ ] asyā T.

<sup>53</sup>kā 4 AG ] kā 4 M; kā 8 AG ] kā 8 M.

<sup>54</sup>kā 2 AG ] kā 2 M.

<sup>55</sup>ity anekavarṇavargavargamūle// G ] ∅ AM.

<sup>56</sup>ghātasya GTPJ(HL) ] vadhasya AMJ, pātasya J(S); etayoḥ sto AMGTJJ(HL) ] etayoste P, etayoḥ ste J(S).

<sup>57</sup>mahatyāḥ AMGTJ ] mahatyā P.

**dvikāṣṭamityos tribhasaṃkhyayoś ca  
yogāntare brūhi pṛthak karaṇyoḥ/  
trisaptamityoś ca ciraṃ vicintya  
cet ṣaḍvidhaṃ vetsi sakhe karaṇyāḥ//E11//<sup>58</sup>**

E11

nyāsaḥ/ ka 2 ka 8/ yoge jātam ka 18/ antare ca ka 2/ dvitīyodāharaṇe nyāsaḥ/  
ka 3 ka 27/ yoge jātam ka 48/ antare ca ka 12/ tṛtīyodāhṛtau nyāsaḥ/ ka 3 ka 7/  
anayor ghāte mūlābhāvāt pṛthaksthitir eva/ yoge jātam ka 3 ka 7/ antare ca ka 3  
ka 7//E11p1//<sup>59</sup>

iti karaṇīsaṃkalanavyavakalane//E11p2//  
guṇanodāharaṇam/E12p0/

**dvitryaṣṭasaṃkhyā guṇakaḥ karaṇyo  
guṇyas trisaṃkhyā ca sapañcarūpā/  
vadhaṃ pracakṣvāśu vipañcarūpe  
guṇo 'thavā tryarkamite karaṇyau//E12//<sup>60</sup>**

E12

nyāsaḥ/ guṇakaḥ ka 2 ka 3 ka 8/ guṇyaḥ ka 3 rū 5/ atra guṇye guṇake vā bhājye  
bhājake vā karaṇīnām karaṇyor vā yathāsaṃbhavaṃ lāghavārthaṃ yogaṃ kṛtvā  
guṇanabhajane kārye/ tathā kṛte jāto guṇakaḥ ka 18 ka 3/ guṇyaḥ ka 25 ka 3/  
guṇite jātam rū 3 ka 450 ka 75 ka 54//E12p1//

viśeṣasūtraṃ vṛttam/15p0/

**kṣayo bhavec ca kṣayarūpavargaś  
cet sādhyate 'sau karaṇītvahetoḥ/  
ṛṇātmikāyāś ca tathā karaṇyā  
mūlaṃ kṣayo rūpavidhānahetoḥ//15//**

15

dvitīyodāharaṇe nyāsaḥ/ guṇakaḥ ka 25 ka 3 ka 12/ guṇyaḥ ka 25 ka 3/ atra  
guṇake karaṇyor yoge kṛte guṇakaḥ ka 25 ka 27/ guṇite jātam ka 625 ka 675 ka 75  
ka 81/ etāsv anayoḥ ka 625 ka 81 mūle rū 25 rū 9/ anayor yoge jātam rū 16/ anayoḥ  
ka 675 ka 75 antare yoga iti jāto yogaḥ ka 300/ yathākramaṃ nyāsaḥ/ rū 16 ka  
300//E12p2//<sup>61</sup>

<sup>58</sup>pṛthak AMGTJJ(HL) ] sakhe PJ(S); mityoś ca ciraṃ AMGPJJ(HL) ] mityoścaritaṃ T, mityāś-  
caciraṃ J(S); vidhaṃ AMGTPJJ(HL) ] bhidhaṃ J(S).

<sup>59</sup>tṛtīyodāhṛtau AM ] tṛtīyodāharaṇe G.

<sup>60</sup>karaṇyo AMJ ] karaṇyor GTP; sapañcarūpā AMGPJ ] sa pañcarūpā T; guṇo J(HS) ] guṇe AMGP,  
guṇyo T, guṇye JJ(L).

<sup>61</sup>rū 16 (1st) AG ] rū 16 M; ka 75 (2nd) AG ] ka 75 M.

iti karaṇḡguṇanam//E12p3//

pūrvaguṇanaphalasya svaguṇacchedasya bhāgahārārthaṃ nyāsaḥ/ bhājyaḥ ka 9 ka 450 ka 75 ka 54/ bhājakaḥ ka 2 ka 3 ka 8/ atra ka 2 ka 8 etayoḥ karaṇyor yoge kṛte jātam ka 18 ka 3/ 'bhājyāc chedaḥ śudhyati pracyutaḥ san' (BG 11a) ityādikaraṇena labdho guṇyaḥ rū 5 ka 3//E12p4//

dvitīyodāharaṇe nyāsaḥ/ bhājyaḥ ka 256 ka 300/ bhājakaḥ ka 25 ka 3 ka 12/ karaṇyor yoge kṛte jātam ka 25 ka 27/ atrādaḥ tribhir guṇayitvā dhanakaraṇyor ṛnakaraṇyoś ca yogaṃ vidhāya paścāt pañcaviṃśatyā guṇayitvā śodhite labdham rū 5 ka 3/ atrāpi pūrvalabdhho guṇyaḥ rū 5 ka 3//E12p5//<sup>62</sup>

athavānyathocyate/16p0/<sup>63</sup>

**dhanarṇatāvyatyayam īpsitāyās** 16

**chede karaṇyā asakṛd vidhāya/**

**tādrkchidā bhājyaharau nihanyād**

**ekaiva yāvat karaṇī hare syāt//16//<sup>64</sup>**

**bhājyās tayā bhājyagatāḥ karaṇyo** 17

**labdhāḥ karaṇyo yadi yogajāḥ syuḥ/**

**viśleṣasūtreṇa pṛthak ca kāryās**

**tathā yathā praṣṭur abhīpsitāḥ syuḥ//17//<sup>65</sup>**

tathā ca viśleṣasūtraṃ vṛttam/18p0/

**vargeṇa yogakaraṇī vihr̥tā viśudhyet** 18

**khaṇḍāni tatkr̥tipadasya yathepsitāni/**

**kṛtvā tadīyakṛtayaḥ khalu pūrvalabdhya**

**kṣuṇṇā bhavanti pṛthag evam imāḥ karaṇyaḥ//18//<sup>66</sup>**

nyāsaḥ/ bhājyaḥ ka 9 ka 450 ka 75 ka 54/ bhājakaḥ ka 18 ka 3/ atra bhājake trimitakaraṇyā ṛṇatvaṃ prakalpya ka 18 ka 3/ anena bhājye guṇite yoge ca kṛte jātam ka 5625 ka 675/ bhājake ca ka 225/ anayā bhājye hr̥te labdham ka 25 ka

<sup>62</sup>The editor of G refers to a manuscript that omits the passage 'atrādaḥ ... labdham rū 5 ka 3.' This passage occurs in all of AMG but, as it is too explanatory and overlaps with the next sentence, it is presumably a later interpolation.

<sup>63</sup>athavānyathocyate AM ] athānyathocyate G.

<sup>64</sup>harau AMGTPJJ(HL) ] haro J(S).

<sup>65</sup>tayā AMGTPJJ(LS) ] tathā J(H); pṛthak ca kāryās tathā yathā AMGJ ] pṛthakkāryāstathā yathā T, pṛthakca kāryā yathā tathā P; praṣṭur AMGTPJJ(HL) ] praṣṭur J(S).

<sup>66</sup>viśudhyet AGP ] viśuddhyet MTJJ(HL), viśuddhet J(S); khaṇḍāni AMGTPJ(HS) ] khaṇḍā J(L); kṣuṇṇā AMTPJ ] kṣuṇṇāḥ G.



3//18p1//<sup>67</sup>

dvitīyodāharaṇe nyāsaḥ/ bhājyaḥ ka 25<sup>6</sup> ka 300/ bhājakaḥ ka 25<sup>6</sup> ka 27/ atra bhājake pañcaviṃśatikaraṇyā dhanatvaṃ prakalpya ka 25 ka 27 bhājye guṇite dhana-  
rṇakaraṇīnām antare ca kṛte jātam ka 100 ka 12/ bhājake ca ka 4/ anayā bhājye  
hr̥te labdham ka 25 ka 3//18p2//<sup>68</sup>

idānīm pūrvodāharaṇe guṇye bhājake kṛte nyāsaḥ/ bhājyaḥ ka 9 ka 450 ka 75  
ka 54/ bhājakaḥ ka 25 ka 3/ atrāpi trimitakaraṇyarnatvaṃ prakalpya bhājye guṇite  
yute ca jātam ka 8712 ka 1452/ bhājake ca ka 484/ anayā hr̥te bhājye labdho guṇakaḥ  
ka 18 ka 3/ pūrvam guṇake khaṇḍatrayam āsīd iti yogakaraṇīyam ka 18 viśeṣyā/  
tatra ‘vargeṇa yogakaraṇī vihr̥tā viśudhyet’ (BG 18a) iti navātmakavargeṇa 9 vihr̥tā  
satī śudhyatīti labdham 2/ navānām mūlam 3/ asya khaṇḍe 1/ 2/ anayoḥ kṛtī 1/  
4/ pūrvabdhya 2 guṇite 2/ 8/ evaṃ jāto guṇakaḥ ka 2 ka 3 ka 8//18p3//<sup>69</sup>

karaṇīvargāder udāharaṇam/E13p0/

**dvikatripañcapramitāḥ karaṇyas**

E13

**tāsām kṛtīm tridvikasamkhyayoś ca/**

**ṣaṭpañcakatridvikasammitānām**

**pr̥thak pr̥thañ me kathayāśu vidvan//E13//<sup>70</sup>**

**aṣṭādaśaṣṭadvikasammitānām**

E14ab

**kṛtīkṛtānām ca sakhe padāni/E14ab//<sup>71</sup>**

nyāsaḥ/ prathamah ka 2 ka 3 ka 5/ dvitīyah ka 3 ka 2/ tr̥tīyah ka 6 ka 5 ka 3  
ka 2/ caturthah ka 18 ka 8 ka 2/ ‘sthāpyo ’ntyavargaś caturguṇāntyanighnāḥ’<sup>72</sup> ity  
anena ‘guṇyah pr̥thag guṇakakhaṇḍasamo ⟨niveśyas⟩’ (BG 10a) ity anena vā jātāḥ  
krameṇa vargāḥ/ prathamah rū 10 ka 24 ka 40 ka 60/ dvitīyah rū 5 ka 24/ tr̥tīyah  
rū 16 ka 120 ka 72 ka 60 ka 48 ka 40 ka 24/ atrāpi karaṇīnām yathāsambhavaṃ  
yogaṃ kṛtvā vargavargamūle kārye/ tad yathā ka 18 ka 8 ka 2/ āsām yogaḥ ka 72/  
asyā vargaḥ ka 5184/ asyā mūlam rū 72//E14abp1//<sup>73</sup>

iti karaṇīvargaḥ//E14abp2//

<sup>67</sup>bhājye hr̥te (1st) AM ] hr̥te bhājye G.

<sup>68</sup>ka 25<sup>6</sup> AG ] ka<sup>o</sup> 25<sup>6</sup> M; ka 100 AM ] ka 300 G.

<sup>69</sup>navānām AM ] navānām 9 G.

<sup>70</sup>tridvika (1st) AMGJJ(L) ] dvitrika TPJ(HS); tridvika (2nd) AMGJJ(H) ] dvitrika TPJ(S), trikad-  
vika J(L).

<sup>71</sup>kṛtīkṛtānām AMGTJ(HLS) ] kṛtī kṛtānām PJ.

<sup>72</sup>This is a modification on L 19, which reads dvi instead of catur.

<sup>73</sup>vargaś caturguṇāntya G ] vargaśca caturgaṇāntya AM; ka 72 (1st) AG ] 72 M; ka 40 ka 24 G ]  
ka0 24 AM.

karaṇīmūle sūtram vṛttadvayam/19p0/<sup>74</sup>

**varge karaṇyā yadi vā karaṇyos tulyāni rūpāṇy athavā bahūnām/** 19  
**viśodhayed rūpakṛteḥ padena śeṣasya rūpāṇi yutonitāni//19//**  
**prthak tadardhe karaṇīdvayam syān** 20  
**mūle 'tha bahvī karaṇī tayor yā/**  
**rūpāṇi tāny evam ato 'pi bhūyaḥ**  
**śeṣāḥ karaṇyo yadi santi varge//20//<sup>75</sup>**

udāharaṇam/ prathamavargasya mūlārtham nyāsaḥ/ rū 10 ka 24 ka 40 ka 60/ rūpakṛteḥ 100 caturviṃśaticatvāriṃśatkaraṇyos tulyāni rūpāṇy apāsyā śeṣam 36/ asya mūlam 6/ anenonādhikarūpāṇām ardhe jāte 2/ 8/ tatrāpiyaṃ 2 mūla-karaṇī/ dvitīyām rūpāṇy eva prakalpya punaḥ śeṣakaraṇībhiḥ sa eva vidhiḥ kāryaḥ/ tatreyam rūpakṛtiḥ 64/ asyāḥ ṣaṣṭirūpāṇy apāsyā śeṣam 4/ asya mūlam 2/ anenonādhikarūpāṇām ardhe 3/ 5 jāte mūlakaraṇyau ka 3 ka 5/ mūlakaraṇīnām yathākramam nyāsaḥ/ ka 2 ka 3 ka 5//20p1//<sup>76</sup>

dvitīyavargasya nyāsaḥ/ rū 5 ka 24/ rūpakṛteḥ 25 karaṇītulyāni rūpāṇi 24 apāsyā śeṣam 1/ asya mūlena 1 ūnādhikarūpāṇām ardhe jāte mūlakaraṇyau ka 2 ka 3//20p2//<sup>77</sup>

trītyavargasya nyāsaḥ/ rū 16 ka 120 ka 72 ka 60 ka 48 ka 40 ka 24/ rūpakṛteḥ 256 karaṇītritayasyāsyā ka 48 ka 40 ka 24 tulyāni rūpāṇy apāsyoktavaj jāte khaṇḍe 2/ 14/ mahatī karaṇīty asyāḥ 14 kṛtiḥ 196/ asyāḥ karaṇīdvayasyāsyā ka 72 ka 120 tulyarūpāṇy apāsyoktavaj jāte khaṇḍe 6/ 8/ punā rūpakṛteḥ 64 ṣaṣṭirūpāṇy apāsyoktavat khaṇḍe 3/ 5/ evam mūlakaraṇīnām yathākramam nyāsaḥ/ ka 6 ka 5 ka 3 ka 2//20p3//<sup>78</sup>

caturthasya nyāsaḥ/ rū 72 ka 0/ iyaṃ eva labdhā mūlakaraṇī ka 72/ pūrvaṃ khaṇḍatrayam āsīd iti 'vargeṇa yogakaraṇī vihr̥tā viśudhyet' (BG 18a) iti ṣaṭtriṃśatā vihr̥tā śudhyatīti ṣaṭtriṃśato mūlam 6/ etasya khaṇḍānām 1/ 2/ 3 kṛtayaḥ 1/ 4/ 9 pūrvālabdhyānyā 2 kṣuṇṇāḥ 2/ 8/ 18/ evam prthak karaṇyo jātāḥ ka 2 ka 8 ka 18//20p4//<sup>79</sup>

atha vargagataṅkaraṇyā mūlānyānārtham sūtram vṛttam/21p0/

<sup>74</sup>sūtram vṛttadvayam AM ] sūtradvayam G.

<sup>75</sup>evam ato 'pi GTPJ(HS) ] eva kṛtāni AMJ, eva kṛtā J(L).

<sup>76</sup>AM place the paragraph 20p1 after 20p2. udāharaṇam/ AM ] ∅ G; mūlārtham G ] ∅ AM; mūlam 6/ anenonādhika G ] mūlenonādhika AM; tatrāpiyaṃ AM ] atrāpiyaṃ G; mūlakaraṇyau G ] mūlakaraṇī AM.

<sup>77</sup>nyāsaḥ G ] mūlārtham nyāsaḥ AM; mūlena 1 ūnādhika AM ] mūlenonādhika G.

<sup>78</sup>asyāḥ G ] asya AM.

<sup>79</sup>rū 72 ka 0/ G ] rū 72/ AM; 1/ 4/ 9 AM ] 1/ 4/ G.

ṛṇātmikā cet karaṇī kṛtau syād  
 dhanātmikāṃ tāṃ parikalpya sādhye/  
 mūle karaṇyāv anayor abhīṣṭā  
 kṣayātmikaikā sudhiyāvagamyā//21//<sup>80</sup>

21

udāharaṇam/E14cdp0/

trisaptamityor vada me karaṇyor  
 viśeṣavargaṃ kṛtitaḥ padaṃ ca//E14cd//

E14cd

nyāsaḥ/ ka 3̣ ka 7/ yadvā ka 3 ka 7̣/ anayor vargaḥ sama eva rū 10 ka 8̣4/ atra  
 varga ṛṇakarāṇyā dhanatvaṃ prakalpya prāgvallabdhakaraṇyor ekābhīṣṭarṇagatā  
 syād iti jātam ka 3̣ ka 7 vā ka 3 ka 7̣//E14cdp//<sup>81</sup>

udāharaṇam/E15p0/

dvikatripañcapramitāḥ karaṇyaḥ  
 svasvarṇagā vyastadhanarṇagā vā/  
 tāsāṃ kṛtiṃ brūhi kṛteḥ padaṃ ca  
 cet ṣaḍvidhaṃ vetsi sakhe karaṇyāḥ//E15//

E15

nyāsaḥ/ ka 2 ka 3 ka 5̣/ vā ka 2 ka 3̣ ka 5/ āsāṃ vargaḥ sama eva jātaḥ rū 10 ka 24  
 ka 40 ka 60/ atrarṇakarāṇyos tulyāni dhanarūpāni 100 rūpakṛteḥ 100 apāsya śeṣasya  
 mūlam 0/ anenonādhikarūpāṇām ardhe ka 5/ ka 5/ atraikarṇam ka 5/ anyā rūpāṇīti  
 nyāsaḥ/ rū 5 ka 24/ pūrvavaj jāte karaṇyau dhane eva ka 3 ka 2/ yathākramaṃ  
 nyāsaḥ/ ka 2 ka 3 ka 5̣//E15p1//<sup>82</sup>

athavānayoḥ ka 24 ka 60 tulyāni dhanarūpāni 84 rūpakṛteḥ 100 apāsyoktavaj jāte  
 mūlakaraṇyau ka 7 ka 3/ anayor mahaty ṛṇam ka 7/ tāny eva rūpāni prakalpya rū 7  
 ka 40/ ataḥ prāgvat karaṇyau ka 5 ka 2/ anayor api mahaty ṛṇam iti yathākramaṃ  
 nyāsaḥ/ ka 3 ka 2 ka 5̣//E15p2//<sup>83</sup>

atha dvitīyodāharaṇe prāgvat prathamapakṣe mūlakaraṇyau ka 5 ka 5/ anayor

<sup>80</sup>parikalpya AMGTPJJ(HS) ] prakalpya J(L); sādhye AMGTPJJ(HL) ] sāmādhye J(S); sudhi-  
 yāvagamyā AMGTPJJ(HL) ] sudhiyāvāgamyā J(S). J(L) is available up to this verse.

<sup>81</sup>G places E14cdp immediately after E15 (before E15p1). nyāsaḥ AM ] prathamodāharaṇe nyāsaḥ  
 G; yadvā AM ] vā G; atra varga ] atra varge AM, atra vaga G; ekābhīṣṭarṇa ] ekābhīṣṭā ṛṇa AMG.

<sup>82</sup>nyāsaḥ AM ] dvitīyodāharaṇe nyāsaḥ G; atrarṇa ] atra ṛṇa AMG; śeṣasya AM ] 0 G; atraikarṇam  
 ] atraikā ṛṇam AMG; dhane eva M ] dhane eva A, dhanameva G.

<sup>83</sup>ka 24 ka 60 ] ka 24 ka 60 AMG; 100 AM ] 0 G; anayor mahaty ṛṇam ] anayormahatī ṛṇam AG,  
 anayārmahatī ṛṇam M; ka 5 ka 2 AM ] ka 5 ka 3 G; mahaty ṛṇam ] mahatī ṛṇam AMG.

ekarṇam ka 5/ tāny eva rūpāṇīty ṛnotpanne karaṇīkhaṇḍe ṛne eveti yathākramam  
nyāsaḥ/ ka 3 ka 2 ka 5/ dvitīyapakṣeṇāpi yathoktā eva mūlakaraṇyaḥ ka 2 ka 3 ka  
5/ evaṃ buddhimatānuktam api jñāyata iti//E15p3//<sup>84</sup>

pūrvair nāyam artho vistīryokto bālāvabodhārtham tu mayocyate/22p0/

<b>ekādisamkalitamitakaraṇīkhaṇḍāni vargarāśau syuḥ/</b>	22
<b>varge karaṇītritaye karaṇīdvitayasya tulyarūpāni//22//</b>	
<b>karaṇīṣaṭke tisṛṇām</b>	
<b>daśasu catasṛṇām tithiṣu ca pañcānām/</b>	23
<b>rūpakṛteḥ projjhya padam</b>	
<b>grāhyam ced anyathā na sat kvāpi//23//<sup>85</sup></b>	
<b>utpatsyamānayaivam mūlakaraṇyālpayā caturguṇayā/</b>	24
<b>yāsām apavartaḥ syād rūpakṛtes tā viśodhyāḥ syuḥ//24//<sup>86</sup></b>	
<b>apavarte yā labdhā mūlakaraṇyo bhavanti tās cāpi/</b>	25
<b>śeṣavidhinā na yadi tā bhavanti mūlam tadā tad asat//25//<sup>87</sup></b>	

karaṇīvargarāśau rūpair avaśyam bhavitavyam/ ekakaraṇyā varge rūpāṇy eva/  
dvayoḥ sarūpaikā karaṇī/ tisṛṇām tisraḥ/ catasṛṇām ṣaṭ/ pañcānām daśa/  
ṣaṇṇām pañcadaśa ityādi/ ato dvayādīnām karaṇīnām vargeṣv ekādisamkalitamitāni  
karaṇīnām khaṇḍāni rūpāni ca yathākramam syuḥ/ atha yady udāharaṇe tāvanti na  
bhavanti tadā saṃyojya yogakaraṇīm viśleṣya vā tāvanti kṛtvā mūlam grāhyam ity  
arthaḥ/ ‘varge karaṇītritaye karaṇīdvitayasya tulyarūpāni’ (BG 22cd) ityādi spaṣṭā-  
rtham//25p//<sup>88</sup>

udāharaṇam/E16p0/

<b>varge yatra karaṇyo dantaiḥ siddhair gajair mitā vidvan/</b>	E16
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<sup>84</sup>rūpāṇīty ṛnotpanne ] rūpāṇīti ṛnotpanne AMG; ka 3 ka 2 ka 5/ AM ] ka 2 ka 3 ka 5/ G; ka 2 ka  
3 ka 5/ AM ] ka 3 ka 2 ka 5/ G. The passage ‘tāny eva ... nyāsaḥ/ ka 3 ka 2 ka 5/’ is presumably  
a later interpolation.

<sup>85</sup>catasṛṇām AGPJ ] catusṛṇām M, catṛṣṛṇām T; ca AMGTPJ ] ∅ J(HS); projjhya PJJ(S) ] prohya  
AMJ(H), projjhya G, proḍya T; ced anyathā AMGPJ ] vedanyathā T.

<sup>86</sup>karaṇyālpayā AMGPJJ(H) ] karaṇyā alpayā T, karaṇyātmayā J(S).

<sup>87</sup>apavarte yā GTPJ ] apavartādapi AM; na yadi tā AMGPJ ] yadi natā T.

<sup>88</sup>The paragraph 25p has been cited verbatim by the commentator Kṛṣṇa (T, p. 77; P, pp. 52–53).  
vargarāśau AGT(K)P(K) ] vargarāśī M; catasṛṇām AGT(K)P(K) ] catusṛṇām M; pañcadaśa ityādi  
AMG ] pañcadaśa T(K)P(K); ato dvayādīnām AMG ] tato dravyādīnām T(K), tato dvayādīnām  
P(K); karaṇīnām khaṇḍāni rūpāni ca AMG ] karaṇīkhaṇḍāni T(K)P(K); tadā saṃyojya yoga-  
karaṇīm viśleṣya vā tāvanti GT(K)P(K) ] tadāsau yogakaraṇī viśleṣyā vā bhavatīti AMG; rūpāni  
ityādi GT(K)P(K) ] rūpāṇīti AM.

**rūpair daśabhir upetāḥ kiṃ mūlaṃ brūhi tasya syāt//E16//<sup>89</sup>**

nyāsaḥ/ rū 10 ka 32 ka 24 ka 8/ atra ‘varge karaṇītritaye karaṇīdvitayasya’ (BG 22cd) eva tulyāni rūpāṇi prathamam rūpakṛter apāsyā mūlaṃ grāhyam/ punar ekasyā evaṃ kriyamāṇe ’tra padaṃ nāstīty ato ’sya karaṇīgatamūlābhā-  
vaḥ//E16p1//<sup>90</sup>

athāniyamena sarvakaraṇītulyāni rūpāṇy apāsyā mūlam ānīyate/ tad idam ka 2  
ka 8 samāgacchati/ idam asad yato ’sya vargo ’yam rū 18//E16p2//

athavā dantagajamitayor yogam kṛtvā rū 10 ka 72 ka 24 ānīyate/ tad idam apy  
asat rū 2 ka 6//E16p3//

udāharaṇam/E17p0/

**varge yatra karaṇyas tithiviśvahutāśanaś caturguṇitaiḥ/  
tulyā daśarūpādhyāḥ kiṃ mūlaṃ brūhi tasya syāt//E17//**

E17

nyāsaḥ/ rū 10 ka 60 ka 52 ka 12/ atra kila varge karaṇītrayam astīti tatkarāṇī-  
dvayasya dvipañcāśadvādaśamitasya ka 52 ka 12 tulyarūpāṇy apāsyā ye mūla-  
karaṇyāv utpadyete ka 8 ka 2 tayor alpāyānāyā 2 caturguṇayā 8 dvipañcāśad-  
dvādaśamitayor apavarto na syāt/ atas te na śodhye yata uktam ‘utpatsyamāna-  
yaivaṃ (mūlakaraṇyālpayā caturguṇayā)’ (BG 24ab) ityādi/ atrālpayety upalakṣa-  
ṇam/ tena kvacin mahatyāpi/ tadā yāṃ mūlakaraṇīm rūpāṇi prakalpyānye karaṇī-  
khaṇḍe sādhye sā mahatī prakalpyety arthaḥ/ tathā kṛte mūlam ka 2 ka 3 ka 5/  
idam apy asad yato ’sya vargo ’yam rū 10 ka 24 ka 40 ka 60//E17p//<sup>91</sup>

udāharaṇam/E18p0/

**aṣṭau ṣaṭpañcāśat ṣaṣṭiḥ karaṇītrayam kṛtau yatra/  
rūpair daśabhir upetaṃ kiṃ mūlaṃ brūhi tasya syāt//E18//<sup>92</sup>**

E18

nyāsaḥ/ rū 10 ka 8 ka 56 ka 60/ atrādyakhaṇḍadvaye ka 8 ka 56 śodhite ut-  
pannayālpayā caturguṇayā 8 tayorḥ khaṇḍayor apavartanalabdhe khaṇḍe 1/ 7/  
param śeṣavidhinā mūlakaraṇyau notpadyete/ atas te khaṇḍe na śodhye/ anyathā

<sup>89</sup>dantaiḥ siddhair gajair mitā AGPJ ] dantaiḥ simaddhairgajairmitā M, dantaiḥ 32 siddhai 24  
rgajai 8 rmitā T.

<sup>90</sup>dvitayasya eva ] dvitayasyaiva MG, dvitayasyeva A.

<sup>91</sup>tatkarāṇīdvayasya AM ] tatkarāṇīdvaya G; alpāyānāyā 2 AM ] alpāyānāyā G; utpat-  
syamānayaivaṃ MG(-m) ] utpasyamānayaivam A; tadā yāṃ ] tadā AGM; tathā kṛte ... ka 60  
AM ] ∅ G; ’sya vargo A ] ’sya varṇo M.

<sup>92</sup>kṛtau yatra AMGTPJJ(H) ] kṛtau sakhe yatra J(S); rūpair ... syāt (2nd line) AMGTPJJ(H) ]  
∅ J(S).

tu śodhane kṛte mūlaṃ nāyātīty atas tad asat//E18p//<sup>93</sup>  
udāharaṇam/E19p0/

**caturguṇāḥ sūryatithīśurudra-  
nāgartavo yatra kṛtau karaṇyaḥ/  
saviśvarūpā vada tatpadaṃ te  
yady asti bīje paṭutābhimānaḥ//E19//<sup>94</sup>**

E19

nyāsaḥ/ rū 13 ka 48 ka 60 ka 20 ka 44 ka 32 ka 24/ atra ‘karaṇīṣaṭke tisṛṇām’  
(BG 23a) karaṇīnām tulyāni rūpāni prathamam rūpakṛter apāsya mūlaṃ grāhyaṃ  
paścād dvayos tata ekasyāḥ/ evaṃ kṛte ’tra mūlābhāvaḥ/ athānyathā tu prathamam  
ādyakaraṇyos tulyāni rūpāṇy apāsya paścād dvitīyatrīyayos tataḥ śeṣānām rūpa-  
kṛter viśodhyānīti tanmūlam ka 1 ka 2 ka 5 ka 5/ tad idam apy asat/ yato ’sya vargo  
'yam rū 13 ka 8 ka 80 ka 160/ yair asya mūlānayanasya niyamo na kṛtas teṣām idaṃ  
dūṣaṇam/ evaṃvidhavarge karaṇīnām āsannamūlakaraṇena mūlāny ānīya rūpeṣu  
prakṣipyā mūlaṃ vācyam//E19p//<sup>95</sup>

atha mahatī rūpāṇīty upalakṣaṇam/ yataḥ kvacid alpāpi/ tatrodāharaṇam  
/E20p0/

**catvāriṃśadaśītidviśatītulyāḥ karaṇyaś cet/  
saptadaśarūpayuktās tatra kṛtau kiṃ padaṃ brūhi//E20//<sup>96</sup>**

E20

nyāsaḥ/ rū 17 ka 40 ka 80 ka 200/ śodhite jāte khaṇḍe ka 10 ka 7/ punar laghvīm  
karaṇīm rūpāni kṛtvā labdhe karaṇyau ka 5 ka 2/ evaṃ mūlakaraṇīnām nyāsaḥ/ ka  
10 ka 5 ka 2//E20p1//

iti karaṇīṣaḍvidham//E20p2//

iti ṣaṭtriṃśatparikarmāni//E20p3//<sup>97</sup>

<sup>93</sup>tu AM ] ∅ G.

<sup>94</sup>rudranāga AMGTPJ ] rudrā nāga, a variant mentioned by Kṛṣṇa; vada tat AMGTPJJ(H) ] vadat  
J(S).

<sup>95</sup>athānyathā AM ] anyathā G; viśodhyānīti tanmūlam AM ] viśodhyānītaṃ mūlam G; rū 13 (2nd)  
M ] rū 23 AG.

<sup>96</sup>aśīti AGTPJ ] aśītir M, a variant mentioned by Kṛṣṇa; karaṇyaś AMGTPJ ] karaṇyāś T; tatra  
kṛtau AMGTPJ ] yatra kṛtau tatra, a variant mentioned by Kṛṣṇa.

<sup>97</sup>The concept of ‘36 parikarmāni’ seems to consist of the 6 parikarmāni each for positive numbers  
(dhana), negative numbers (ṛṇa), zero (kha), a single unknown number (avyakta), unknown numbers  
(aneka-varṇa), and karaṇīs. The editor of G reports that some of the manuscripts he used omit this  
colophon.

II.5 Kuṭṭaka<sup>98</sup>

atha kuṭṭakaḥ/26p0/

<p>bhājyo hāraḥ kṣepakaś cāpavartyaḥ  kenāpy ādau sambhave kuṭṭakārtham/  yena chinnau bhājyahārau na tena  kṣepaś cet tad duṣṭam uddiṣṭam eva//26//<sup>99</sup>  parasparaṃ bhājitayor yayor yaḥ  śeṣas tayoh syād apavartanaṃ saḥ/  tenāpavartena vibhājitau yau  tau bhājyahārau dṛḍhasaṃjñakau staḥ//27//<sup>100</sup>  mitho bhajet tau dṛḍhabhājyahārau  yāvad vibhājye bhavatīha rūpam/  phalāny adho 'dhas tadadho niveśyaḥ  kṣepas tathānte kham upāntimena//28//<sup>101</sup>  svordhve hate 'ntyena yute tadantyam  tyajen muhuḥ syād iti rāśiyugmam/  ūrdhvo vibhājyena dṛḍhena taṣṭaḥ  phalaṃ guṇaḥ syād adharo hareṇa//29//<sup>102</sup>  evaṃ tadaivātra yadā samās tāḥ  syur labdhayaś ced viṣamās tadānīm/  yathāgatau labdhiguṇau viśodhyau  svataksaṇāc cheṣamitau tu tau staḥ//30//<sup>103</sup></p>	<p>26 27 28 29 30</p>
<p>bhavati kuṭṭavidher yutibhājyayoḥ  samapavartitayor api vā guṇaḥ/  bhavati yo yutibhājakayoḥ punaḥ  sa ca bhaved apavartanasamguṇaḥ//31//<sup>104</sup></p>	<p>31</p>

<sup>98</sup>Most verses of this chapter occur also in the *Līlāvati* (see Appendix 7). I mention here the variant readings in it, leaving the prose parts for separate treatment.

<sup>99</sup>kṣepaś cet tad J(S) ] kṣepaścaitad AMGTPJJ(H)L.

<sup>100</sup>yaḥ śeṣas AMGTPJL(ASS) ] yaccheṣaṃ L(VIS); saḥ AMGTPJL(ASS) ] tat L(VIS); tenāpavartena AMGTPJL(ASS) ] svenāpavartea L(VIS); saṃjñakau GTPJ ] saṃjñitau AML.

<sup>101</sup>vibhājye AMGTPJL(ASS) ] vibhakte L(VIS); tathānte kham AMTPJL(VIS) ] tathāntye kham G, tataḥ śūnyam L(ASS).

<sup>102</sup>tyajen GTPJL ] tyajyen AM; adharo AMGL(ASS) ] aparo TPJL(VIS).

<sup>103</sup>yadā AMGTPJJ(H)L ] yathā J(S); samās AMGPJL ] samas T; yathāgatau GTPJL ] yadāgatau AM; tu AMGTPJL ] ca J(H), ta J(S).

<sup>104</sup>vidher AMGTPJL(ASS) ] vidhir L(VIS); yuti (1st) MGTPJL ] yurti A; bhājyayoḥ AMGT-

yogaje takṣaṇāc chuddhe guṇāptī sto viyogaje/	32
dhanabhājyodbhave tadvad bhavetām ṛṇabhājyaje/	
guṇalabdhyos samaṃ grāhyaṃ dhīmatā takṣaṇe phalam//32// <sup>105</sup>	
harataṣṭe dhanakṣepe guṇalabdhi tu pūrvavat/	33
kṣepatakṣaṇalābhāḍhyā labdhiḥ śuddhau tu varjitā//33// <sup>106</sup>	
athavā bhāgahāreṇa taṣṭayoḥ kṣepabhājyayoḥ/	34
guṇaḥ prāgvat tato labdhiḥ bhājyād dhatayutoddhṛtāt//34// <sup>107</sup>	
kṣepābhāvo 'thavā yatra kṣepaḥ śudhyed dharoddhṛtaḥ/	35
jñeyah śūnyaṃ guṇas tatra kṣepo harahrtaḥ phalam//35// <sup>108</sup>	
iṣṭāhataśvasvahareṇa yukte	36ab
te vā bhavetām bahudhā guṇāptī/36ab/ <sup>109</sup>	

udāharaṇam/E21p0/

ekaviṃśatiyutaṃ śatadvayaṃ	E21
yadguṇaṃ gaṇaka pañcaṣaṣṭiyuk/	
pañcavarjitaśatadvayoddhṛtaṃ	
śuddhim eti guṇakaṃ vadāsu tam//E21// <sup>110</sup>	

nyāsaḥ/ bhā 221/ hā 195/ kṣe 65/ atra parasparaṃ bhājitayor bhājyabhājakayoḥ śeṣaḥ 13/ anena bhājyahāraḥkṣepā apavartitā jātā dṛḍhāḥ bhā 17/ hā 15/ kṣe 5/ anayor dṛḍhabhājyahārayoḥ parasparaṃ bhaktayor labdham adho 'dhas tadadhaḥ kṣepas tadadhaḥ śūnyaṃ niveśyam iti nyaste jātā vallī

1
7
5
0

'upāntimena svord-

PJJ(H)L ] bhājayoḥ J(S); api GTPJ(HS)L ] atha AMJ; bhavati yo AMGTPJL(ASS) ] atha tayor L(VIS); punaḥ AMGPJL ] ∅ T; bhaved apavartana AMGTJL ] bhavepadavartana P.

<sup>105</sup>yogaje AMGTPJL(ASS) ] kṣepaje L(VIS); sto viyogaje AMGTPJL(ASS) ] te viśuddhije L(VIS); bhājyodbhave tadvad AMGTJL ] bhājyodbhavettadvad J(H), bhājyodbhavettadvad J(S); bhājyaje AMGTPJJ(H) ] bhājake J(S). The L does not have 32cd. J and F place 32ef before 32a. The same order of the verse lines is also reported by Kṛṣṇa to be seen in some manuscripts (pustakas). A variant of 32cd referred to by Kṛṣṇa and by Durgāprasāda (the commentator in G): ṛṇabhājyodbhave tadvad bhavetām ṛṇabhājake (ṛṇabhājyake in G)/

<sup>106</sup>tu pūrvavat AMGTPJJ(H)L ] taparvata J(S); varjitā AMGPJL ] varjitāḥ T.

<sup>107</sup>yutoddhṛtāt AMGPJ ] yutoddhatāt T. The L does not have this verse.

<sup>108</sup>śudhyed dharoddhṛtaḥ GP ] śudhyet haroddhataḥ T, śuddhyeddharoddhṛtaḥ AMJJ(H); śuddho haroddhṛtaḥ J(S)L; jñeyah AMGTPJL(ASS) ] jñeyam L(VIS); guṇas AMGTPJJ(H)L ] guṇas J(S); harahrtaḥ TPL ] hārahṛtaḥ AMGJ.

<sup>109</sup>yukte AMGTPJJ(H)L ] yuktaṃ J(S).

<sup>110</sup>dvayoddhṛtaṃ AMGTPJL ] dvayoddhataṃ T; tam AMGTPJL(ASS) ] me L(VIS).



hve hate' (BG 28d–29a) ityādikaraṇena jātaṃ rāśidvayam  $\frac{40}{35}$  / etau dṛḍhabhājya-  
hārābhyām ābhyām  $\frac{17}{15}$  taṣṭau śeṣamitau labdhiguṇau  $\frac{6}{5}$  / anayoḥ svataksaṇam  
iṣṭaguṇam kṣepa ity athavā labdhiguṇau  $\frac{23}{20}$  /  $\frac{40}{35}$  vetyādi//E21p//<sup>111</sup>  
udāharaṇam/E22p0/

**śataṃ hataṃ yena yutaṃ navatyā  
vivarjitaṃ vā vihrtaṃ triṣaṣṭyā/  
niragrakaṃ syād vada me guṇam taṃ  
spaṣṭam paṭiyān yadi kuṭṭake 'si//E22//<sup>112</sup>**

E22

nyāsaḥ/ bhā 100/ hā 63/ kṣe 90/ atra vallī 

1
1
1
2
2
1
90
0

 'upāntimena' (BG 28d)

ityādinā jātaṃ rāśidvayam  $\frac{2430}{1530}$  / pūrvavā labdhiguṇau  $\frac{30}{18}$  //E22p1//<sup>113</sup>  
athavā bhājyakṣepau daśabhir apavartitau bhā 10/ hā 63/ kṣe 9/ ebhyo 'pi  
pūrvavad vallī 

0
6
3
9
0

 'upāntimena' (BG 28d) ityādinā rāśidvayam  $\frac{27}{171}$  / pūrvavaj

jātau labdhiguṇau  $\frac{7}{45}$  / atra labdhayo viṣamā iti svataksaṇābhyām ābhyām  
 $\frac{10}{63}$  śodhitau jātau labdhiguṇau  $\frac{3}{18}$  / atra labdhir na grāhyā/ guṇaghnabhājye  
kṣepayute harabhakte labdhiś ca 30/ athavā bhājyakṣepāpavartanena 10 pūrvānītā  
labdhir 3 guṇitā saiva labdhiḥ 30//E22p2//<sup>114</sup>

athavā hāraḥkṣepau navabhir apavartitau bhā 100/ hā 7/ kṣe 10/ pūrvavad vallī  

14
3
10
0

 tato jātaṃ rāśidvayam  $\frac{430}{30}$  / takṣaṇe jātam  $\frac{30}{2}$  / hāraḥkṣepāpavartanena

<sup>111</sup>bhā 221/ hā 195/ kṣe 65/ AM ] bhājyaḥ 221/ hāraḥ 195 kṣepaḥ 65 G; śeṣaḥ 13 AM ] śeṣam  
13 G; bhā 17/ hā 15/ kṣe 5/ AM ] bhā. 17/ kṣe. 5/ G; bhājyahārābhyām ābhyām  $\frac{17}{15}$  AM ]  
bhājyahārābhyā  $\frac{17}{15}$  mābhyām G;  $\frac{23}{20}$  /  $\frac{40}{35}$  AM ]  $\frac{23}{0}$  /  $\frac{40}{54}$  G.

<sup>112</sup>vā vihrtaṃ AMGTPJL(ASS) ] vāpi hrtaṃ L(VIS); niragrakaṃ AMGTPJL(ASS) ] niragraḥ  
L(VIS); spaṣṭam AMGPJL ] spaṣṭa T.

<sup>113</sup>bhā 100/ hā 63/ kṣe 90/ AM ] bhājyaḥ 100/ hāraḥ 63/ kṣepaḥ 90 G.

<sup>114</sup>bhā 10/ hā 63/ kṣe 9/ AM ] bhā. 10/ kṣe. 9/ hā. 63/ G; svataksaṇābhyām ābhyām  $\frac{10}{63}$  AM ]  
svataksaṇābhyā  $\frac{10}{63}$  mābhyām G.

9 guṇaṃ saṃguṇya jātau labdhiguṇau tāv eva  $\frac{30}{18}$  //E22p3//<sup>115</sup>

athavā bhājyakṣepau cāpavartya nyāsaḥ/ bhā 10/ hā 7/ kṣe 1/ atra jātā vallī  
 $\left[ \begin{array}{c} 1 \\ 2 \\ 1 \\ 0 \end{array} \right]$  pūrvavaj jātaṃ rāśidvayam  $\frac{3}{2}$  / takṣaṇāj jātaṃ tad eva/ bhājyakṣepahāra-

kṣepāpavartanena krameṇa labdhiguṇau guṇitau tāv eva  $\frac{30}{18}$  / guṇalabdhyoḥ sva-  
 hārau kṣepāv ity athavā labdhiguṇau  $\frac{130}{81}$  vā  $\frac{230}{144}$  ityādi//E22p4//<sup>116</sup>

yogaje guṇāptī  $\frac{18}{30}$  svataḥkṣaṇābhyām ābhyām  $\frac{63}{100}$  śuddhe jāte navatiśuddhau  
 guṇāptī  $\frac{45}{70}$  vā  $\frac{108}{170}$  vā  $\frac{171}{270}$  ityādi//E22p5//  
 udāharaṇam/E23p0/

**yadguṇā kṣayagaṣaṣṭir anvitā**

**varjitā ca yadi vā tribhis tataḥ/**

**syāt trayodaśahr̥tā niragrakā**

**taṃ guṇaṃ gaṇaka me pṛthag vada//E23//<sup>117</sup>**

E23

nyāsaḥ/ bhā  $\frac{60}{51}$ / hā 13/ kṣe 3/ prāgvaj jāte dhanabhājye dhanakṣepe guṇāptī  
 $\frac{11}{51}$  / ete svataḥkṣaṇābhyām ābhyām  $\frac{13}{60}$  śuddhe jāte ṛṇabhājye dhanakṣepe  $\frac{2}{9}$  /  
 atra bhājyabhājakayor vijātīyayor ‘bhāgahāre ‘pi caivaṃ niruktam’ (BG 4b) ity  
 ukatavāl labdher ṛṇatvaṃ jñeyam  $\frac{2}{9}$  / punar ete svataḥkṣaṇābhyām ābhyām  $\frac{13}{60}$   
 śuddhe jāte ṛṇabhājye ṛṇakṣepe guṇāptī  $\frac{11}{51}$  //E23p1//<sup>118</sup>

**‘ṛṇabhājya ṛṇakṣepe dhanabhājyavidhir bhavet/**

**tadvat kṣepa ṛṇagate vyastaṃ syād ṛṇabhājake’//Q0//<sup>119</sup>**

Q0

<sup>115</sup>bhā 100/ hā 7/ kṣe 10/ AM ] bhā. 100/ kṣe. 10/ G; tato AM ] ∅ G; 9 MG ] ∅ A.  
 hā. 7/

<sup>116</sup>bhājyakṣepau cāpavartya AM ] bhājyakṣepau hāraḥkṣepau cāpavartya G; bhā 10/ hā 7/ kṣe 1/  
 AM ] bhā. 10/ kṣe. 1/ G.  
 hā. 7/

<sup>117</sup>kṣayaga AMGTPJ ] gaṇaka L; varjitā ca AMGTPJL(ASS) ] vārjitātha L(VIS); yadi vā trib-  
 his tataḥ AMGTPJ ] daśabhiḥ ṣaḍuttaraiḥ L; trayodaśahr̥tā AMGPJL ] trayodaśahr̥tā T; taṃ  
 AMGTPJL(VIS) ] tad L(ASS); gaṇaka AMGTPJ ] kathaya L; vada AMGTPJ ] pṛthak L.

<sup>118</sup>bhā  $\frac{60}{51}$ / hā 13/ kṣe 3/ ] bhā 60/ hā 13/ kṣepaḥ 3/ AM, bhājyaḥ  $\frac{6}{9}$ / kṣepaḥ 3/ G; prāgvaj jāte  
 hāraḥ 13/  
 AG ] prāgvajjāte M; svataḥkṣaṇābhyām (twice) AM ] svasvataḥkṣaṇābhyām G;  $\frac{2}{9}$  M ]  $\frac{2}{9}$  AG;

$\frac{13}{60}$  ]  $\frac{13}{60}$  AMG;  $\frac{11}{51}$  ]  $\frac{11}{51}$  AMG.

<sup>119</sup>Source unidentified. bhājya ṛṇa G ] bhājye ṛṇa AM; kṣepa ṛṇa ] kṣepe ṛṇa AM, kṣepe dhana G.

‘dhanabhājyodbhave tadvad bhavetām ṛṇabhājyaje’//Q1//<sup>120</sup>

Q1

iti mandāvabodhārthaṃ mayoktam/ anyathā ‘yogaje takṣaṇāc chuddhe’ (BG 32a) ityādinaiva siddhaṃ yata ṛṇadhanayogo viyoga eva/ ata eva bhājyabhājakakṣepāṇāṃ dhanatvam eva prakalpya guṇāptī sādhye/ te yogaje bhavataḥ/ te svataṣṣaṇābhyaṃ śuddhe viyogaje kārye/ bhājye bhājake varṇagate parasparabhajanāl labdhaya ṛṇagatāḥ sthāpyā iti kiṃ tena prayāsenā/ tathā kṛte sati ‘bhājyabhājakayor ekasmin ṛṇagate guṇāptī dvau rāśī kṣipet tatra’ ityādinā paroḥkṣāntreṇa labdhau vyabhicāraḥ syāt//E23p2//<sup>121</sup>

udāharaṇam/E24p0/

aṣṭādaśa hatāḥ kena daśādhyā vā daśonitāḥ/

E24

śuddhaṃ bhāgaṃ prayacchanti kṣayagaikādaśodhṛtāḥ//E24//<sup>122</sup>

nyāsaḥ/ bhā 18/ hā 11/ kṣe 10/ atra bhājakasya dhanatvaṃ prakalpya sādhitau labdhiguṇau  $\frac{14}{8}$  / etāv evarṇabhājake kiṃtu labdheḥ pūrvavad ṛṇatvaṃ jñeyam/ tathā kṛte jātāu labdhiguṇau  $\frac{14}{8}$  / ṛṇakṣepe tu ‘yogaje takṣaṇāc chuddhe’ (BG 32a) ityādinā labdhiguṇau  $\frac{4}{3}$  / bhājakasya dhanatva ṛṇatve vā labdhiguṇāv etāv eva paraṃtu bhājake bhājye varṇagate labdher ṛṇatvaṃ sarvatra jñeyam//E24p//<sup>123</sup>

udāharaṇam/E25p0/

yena saṃguṇitāḥ pañca trayoviṃśatisaṃyutāḥ/

E25

varjitā vā tribhir bhaktā niragrāḥ syuḥ sa ko guṇaḥ//E25//<sup>124</sup>

nyāsaḥ/ bhā 5/ hā 3/ kṣe 23/ atra vallī  $\begin{vmatrix} 1 \\ 1 \\ 23 \\ 0 \end{vmatrix}$  pūrvavaj jātaṃ rāśidvayaṃ  $\frac{46}{23}$  /

atra takṣaṇe ‘dhorāśau sapta labhyante/ ūrdhvarāśau tu nava labhyante/ te nava na grāhyāḥ/ ‘guṇalabdhyoḥ samaṃ grāhyaṃ dhīmatā takṣaṇe phalam’ (BG 32ef) iti/

<sup>120</sup>Cited from BG 32cd.

<sup>121</sup>siddhaṃ yata AM ] tatsiddheḥ/ G; ṛṇadhanayogo AM ] ṛṇadhanayoryogo G; parasparabhajanāl AM ] parasparaṃ bhajanāl G; labdhaya ṛṇa AM ] labdhayaḥ ṛṇa G; kiṃ tena prayāsenā AM ] kiṃ prayāsenā G.

<sup>122</sup>hatāḥ AMGTJJ(H) ] guṇāḥ PJ(S); śuddhaṃ bhāgaṃ AMGTP ] śuddhabhāgaṃ J; daśodhṛtāḥ AMPJ ] daśodhatāḥ GT. The L does not have this verse.

<sup>123</sup>bhā 18/ hā 11/ kṣe 10/ AM ] bhājyaḥ 18/ kṣepaḥ 10/ hāraḥ 11 G;  $\frac{14}{8}$  AM ]  $\frac{14}{8}$  G; yogaje GM ] yogage A.

<sup>124</sup>niragrāḥ syuḥ sa AMGTPJL(ASS) ] niragrā vada L(VIS).

ataḥ saptaiva grāhyā iti jātau labdhiguṇau  $\frac{11}{2}$  yogajau/ etau svasvataksaṇābhyām  
śodhitau jātau ṛṇakṣepe  $\frac{6}{1}$  / 'iṣṭāhataśvasvahareṇa yukte' (BG 36a) iti dviguṇitau  
svasvahārau kṣepyau yathā dhanalabdhiḥ syād iti kṛte jātau labdhiguṇau  $\frac{4}{7}$  / evaṃ  
sarvatra jñeyam//E25p1//<sup>125</sup>

athavā 'harataṣṭe dhanakṣepe (guṇalabdhi tu pūrvavat)' (BG 33ab) iti nyāsaḥ/  
bhā 5/ hā 3/ kṣe 2/ pūrvavaj jātau labdhiguṇau yogajau  $\frac{4}{2}$  / etau svataksaṇā-  
bhyām śuddhau  $\frac{1}{1}$  jātau viyogajau/ 'kṣepataksaṇalābhādhyā labdhiḥ' (BG 33cd)  
iti kṣepataksaṇalābhena 7 yogajalabdhir yutā 11 jātā yogajaiva labdhiḥ/ 'śuddhau  
tu varjitā' (BG 33d) iti takṣaṇalābhena 7 labdhir iyam 1 varjitā  $\frac{6}{1}$ / dhanalabdhy-  
arthaṃ dviguṇe hare kṣipte jātau tāv eva labdhiguṇau  $\frac{4}{7}$  //E25p2//<sup>126</sup>

athavā 'bhāgahāreṇa taṣṭayoh' (BG 34ab) iti nyāsaḥ/ bhā 2/ hā 3/ kṣe 2/ atrāpi  
jātaṃ rāśidvayam  $\frac{2}{2}$  / atrāpi jātaḥ pūrva eva guṇaḥ 2/ labdhis tu 'bhājyād dhata-  
yutoddhṛtāt' (BG 34d) iti guṇa2guṇito bhājyaḥ 10 kṣepa23yuto 33 hara3bhakto  
labdhiḥ saiva 11//E25p3//<sup>127</sup>

udāharaṇam/E26p0/<sup>128</sup>

**yena pañca guṇitāḥ kṣaṣamṃyutāḥ**

E26

**pañcaṣaṣṭisāhitās ca te 'thavā/**

**syus trayodaśahṛtā niragrakās**

**taṃ guṇaṃ gaṇaka kīrtayāśu me//E26//<sup>129</sup>**

nyāsaḥ/ bhā 5/ hā 13/ kṣe 0/ kṣepābhāve guṇāpti  $\frac{0}{0}$  / evaṃ pañcaṣaṣṭikṣepe  
 $\frac{0}{5}$  vā  $\frac{13}{10}$  ityādi//E26p//<sup>130</sup>  
atha sthirakuṭṭake sūtraṃ vṛttam/36cdp0/

**kṣepaṃ viśuddhiṃ parikalpya rūpaṃ**

36cd

**pṛthak tayor ye guṇakāralabdhiḥ//36cd//<sup>131</sup>**

<sup>125</sup>bhā 5/ hā 3/ kṣe 23/ AM ] bhā.  $\frac{5}{hā 3/}$  kṣe 23/ G;  $\frac{6}{1}$  ]  $\frac{6}{1}$  AMG; yukte iti AM ] yuktāviti G.

<sup>126</sup>athavā AM ] ∅ G; bhā 5/ hā 3/ kṣe 2/ AM ] bhā.  $\frac{5}{hā 3/}$  kṣe. 2/ G; 7 (1st) AM ] ∅ G; 11 AM ] 1  
G; yogajaiva AM ] yogajā G; 7 (2nd) M ] ∅ AG.

<sup>127</sup>bhā 2/ hā 3/ kṣe 2/ AM ] bhā.  $\frac{2}{hā 3/}$  kṣe 2/ G;  $\frac{2}{2}$  / AM ]  $\frac{2}{2}$  takṣaṇājjātṃ  $\frac{2}{2}$  G; yutoddhṛtāt  
A(-d) ] yutoddhatād MG; guṇa2guṇito G ] guṇaḥ 2 guṇito AM; hara3bhakto G ] harabhakto AM.

<sup>128</sup>udāharaṇam/ MG ] ∅ A.

<sup>129</sup>'thavā AMGTPJJ(H)L ] tathā J(S); trayodaśahṛtā AMGTJL ] trayodaśa hṛtā P.

<sup>130</sup>bhā 5/ hā 13/ kṣe 0/ AM ] bhājyaḥ 5/ hārah 13/ kṣepaḥ 0/ G;  $\frac{0}{5}$  G ]  $\frac{5}{0}$  AM.

<sup>131</sup>kṣepaṃ viśuddhiṃ parikalpya rūpaṃ AMGTPJ ] kṣepe rūpe yadi vā viśuddhau L(VIS), kṣepe

**abhīpsitakṣepaviśuddhinighnyau**  
svahārataṣṭe bhavatas tayos te/37ab/<sup>132</sup>

37ab

prathamodāharāṇe (BG E21) ṛḍḍhabhājyahārāyo rūpakṣepasya ca nyāsaḥ/ bhā  
17/ hā 15/ kṣe 1/ atroktavad guṇāptī  $\frac{7}{8}$  / ete abhīṣṭakṣepapañcaguṇe svahārataṣṭe  
jāte  $\frac{5}{6}$  te eva/ atha rūpaśuddhau guṇāptī  $\frac{8}{9}$  / ete pañcakaguṇe svahārataṣṭe jāte  
 $\frac{10}{11}$  / evaṃ sarvatra//37abp//<sup>133</sup>

asya gaṇitasya grahagaṇite mahān upayogaḥ/ tadarthaṃ kiṃcid ucyate/  
37cdp0/<sup>134</sup>

**kalpyātha śuddhir vikalāvaśeṣaṃ**  
**ṣaṣṭiś ca bhājyaḥ kudināni hāraḥ//37cd//<sup>135</sup>**  
**tajjaṃ phalaṃ syur vikalā guṇas tu**  
**liptāgram asmāc ca kalā lavāgram/**  
**evaṃ tadūrdhvaṃ ca tathādhimāsā-**  
**vamāgrakābhyāṃ divasā ravīndvoḥ//38//<sup>136</sup>**

37cd

38

grahasya vikalāvaśeṣād grahāharganaḥāyor ānayanam/ tatra ṣaṣṭir bhājyaḥ/  
kudināni hāraḥ/ vikalāvaśeṣaṃ śuddhir iti prakalpya guṇāptī sādhye/ tatra lab-  
dhir vikalāḥ syuḥ/ guṇas tu kalāvaśeṣaṃ/ evaṃ kalāvaśeṣaṃ śuddhiṃ prakalpya  
tatra labdhiḥ kalāḥ/ guṇo bhāgaśeṣaṃ/ bhāgaśeṣaṃ śuddhis triṃśad bhājyaḥ  
kudināni hāraḥ/ tatra phalaṃ bhāgā guṇo rāśiśeṣaṃ/ dvādaśa bhājyaḥ kudināni  
hāro rāśiśeṣaṃ śuddhiḥ/ tatra phalaṃ gatarāśayaḥ/ guṇo bhagaṇaśeṣaṃ/ evaṃ  
kalpabhagaṇā bhājyaḥ kudināni hāro bhagaṇaśeṣaṃ śuddhiḥ/ phalaṃ gata-  
bhagaṇāḥ/ guṇo 'harganaḥ syād iti/ asyodāharaṇāni (golādhyāyāntargata)praśnā-  
dhyāye//38p1//<sup>137</sup>

rūpe yadi vā viśuddhe L(ASS); pṛthak tayor AMGTPJJ(S) ] pṛthak pṛthag J(H), syātāṃ kramād  
L.

<sup>132</sup>nighnyau AMT ] nighne GPJL.

<sup>133</sup>bhā 17/ hā 15/ kṣe 1/ AM ] bhā. 17/ kṣe. 1/ G; jāte  $\frac{5}{6}$  te eva G ] jāte  $\frac{5}{6}$  AM; evaṃ  
sarvatra ] te eva/ evaṃ sarvatra G, te eva sarvatra AM.

<sup>134</sup>A includes this passage ('asya ... kiṃcid ucyate') in 37abp.

<sup>135</sup>vikalāvaśeṣaṃ AMGTPJ ] vikalāvaśeṣaḥ L; bhājyaḥ MGTPJL ] bhājya A.

<sup>136</sup>vikalā guṇas AMGPJL ] vikalāguṇas T; tadūrdhvaṃ AMGT(cor)PJL ] tadardhaṃ T; tathā  
AMGPJL ] tadā T; kābhyāṃ AMGTJL ] kābhyo P; divasā ravīndvoḥ AMGPJL ] divasāravīndvoḥ  
T.

<sup>137</sup>tatra ṣaṣṭir T(K)P(K) ] tadyathā/ ṣaṣṭir AM, tadyathā/ tatra ṣaṣṭir G; guṇāptī sādhye T(K)P(K)  
] sādhye guṇāptī AMG; labdhir vikalāḥ AMGP(K) ] labdhirviphalāḥ T(K); kalāvaśeṣaṃ śuddhiṃ  
prakalpya tatra labdhiḥ kalāḥ/ guṇo bhāgaśeṣaṃ T(K)P(K) ] kalāvaśeṣaṃ śuddhiḥ/ ṣaṣṭirbhājyaḥ

evaṃ kalpādhimāsā bhājyaḥ/ ravidināni hāraḥ/ adhimāsaśeṣaṃ śuddhiḥ/ phalaṃ  
gatādhimāsāḥ/ guṇo gataravidivasāḥ//38p2//<sup>138</sup>

evaṃ yugāvamāni bhājyaḥ/ cāndradivasā hāraḥ/ avamaśeṣaṃ śuddhiḥ/ phalaṃ  
gatāvamāni/ guṇo gatacāndradivasā iti//38p3//<sup>139</sup>

atha saṃśliṣṭakuṭṭake karaṇasūtraṃ vṛttam/39p0/

**eko haraś ced guṇakau vibhinnau**

39

**tadā guṇaikyaṃ parikalpya bhājyam/**

**agraikyaṃ agraṃ kṛta uktavad yaḥ**

**saṃśliṣṭasamjñāḥ sphuṭakuṭṭako 'sau//39//<sup>140</sup>**

udāharaṇam/E27p0/

**kaḥ pañcanighno vihr̥tas triṣaṣṭyā**

E27

**saptāvaśeṣo 'tha sa eva rāśiḥ/**

**daśāhataḥ syād vihr̥tas triṣaṣṭyā**

**caturdaśagro vada rāśim enam//E27//<sup>141</sup>**

atra guṇaikyaṃ bhājyaḥ/ agraikyaṃ śuddhir iti nyāsaḥ/ bhā 15/ hā 63/ kṣe 21/  
pūrvavaj jāto guṇaḥ 14/ ayam eva rāśiḥ//E27p1//<sup>142</sup>

kudināni hāraḥ/ phalaṃ kalāḥ/ guṇomaśaśeṣaṃ AM, kalāvaśeṣālabdhiḥ kalā guṇo bhāgaśeṣaṃ G;  
bhāgaśeṣaṃ śuddhis triṃśad bhājyaḥ kudināni hāraḥ/ tatra phalaṃ bhāgā (bhāgaḥ T(K)) guṇo  
rāśiśeṣaṃ T(K)P(K) ] ∅ AM, tadbhāgaśeṣaṃ śuddhiḥ/ kudināni hāraḥ/ triṃśadbhājyaḥ/ tatra  
labdhirbhāgāḥ/ guṇo rāśiśeṣaṃ/ G; dvādaśa bhājyaḥ kudināni hāro rāśiśeṣaṃ śuddhiḥ T(K)P(K)G ]  
evaṃ rāśiśeṣaṃ śuddhirdvādaśabhājyaḥ/ kudināni hāraḥ AM; tatra phalaṃ gatarāśayaḥ T(K)P(K)  
] phalaṃ gatarāśayaḥ AM, tatra phalaṃ rāśayaḥ G; evaṃ kalpabhagaṇā bhājyaḥ T(K)P(K)AM  
] bhagaṇā bhājyaḥ G; phalaṃ gatabhagaṇāḥ T(K)AMG ] tatra phalaṃ gatabhagaṇāḥ P(K);  
praśnādhyāye T(K)P(K)G ] tripraśnādhyāye AM.

<sup>138</sup>phalaṃ T(K)P(K)AM ] labdhir G.

<sup>139</sup>yugāvamāni T(K)P(K)AM ] kalpāvamāni G; cāndradivasā AMG ] candradivasā T(K) P(K);  
hāraḥ/ avamaśeṣaṃ G ] hara avamaśeṣaṃ T(K), haro 'vamaśeṣaṃ AM, haraḥ/ avamaśeṣaṃ P(K);  
gatacāndra T(K)P(K)G ] gatacandra AM.

<sup>140</sup>vibhinnau AMGTPJL(ASS) ] tu bhinnau L(VIS); kṛta uktavad AMGTPL ] kṛtamuktavad J;  
sphuṭa AMGPJL ] sphuṭha T.

<sup>141</sup>pañca AMGPJL ] śacca T; triṣaṣṭyā (1st) AMGPJL ] triṣaṣṭhyā T; saptāvaśeṣo GTPJL ]  
saptāvaśeṣo AM; triṣaṣṭyā (2nd) AMGPJL ] triṣaṣṭā T. JF are available up to this verse.

<sup>142</sup>bhājyaḥ G ] bhājyo 'yam eva rāśiḥ AM; śuddhir iti nyāsaḥ ] śuddhiriti/ nyāsaḥ AM, śuddhiḥ/  
nyāsaḥ G; bhā 15/ hā 63/ kṣe 21/ ] bhā 15/ hā 63/ kṣepaḥ 21/ A, bhā 15/ hā 63/ kṣepaḥ 21/ M,  
bhājyaḥ 15/ hāraḥ 63/ kṣepaḥ 21/ G; pūrvavaj jāto MG ] pūrvajjāto A; ayam eva rāśiḥ G ] labdhiḥ  
3 AM.

iti bhāskarīye bījagaṇite kuṭṭakaḥ//E27p2//<sup>143</sup>

## II.6 varga-prakṛti<sup>144</sup>

### II.6.1 Varga-prakṛti

atha vargaprakṛtiḥ//40p1//

tatra rūpakṣepapadārtham tāvat karaṇasūtrāṇi sārḍhaṣaḍ vṛttāni/40p0/<sup>145</sup>

<p> <b>iṣṭam hrasvam tasya vargaḥ prakṛtyā</b>  <b>kṣuṇṇo yukto varjito vā sa yena/</b>  <b>mūlam dadyāt kṣepakam tam dhanarṇam</b>  <b>mūlam tac ca jyeṣṭhamūlam vadanti//40//</b>  <b>hrasvajyeṣṭhakṣepakān nyasya teṣām</b>  <b>tān anyān vādho niveśya krameṇa/</b>  <b>sādhyāny ebhyo bhāvanābhir bahūni</b>  <b>mūlāny eṣām bhāvanā procyate 'taḥ//41//</b>  <b>vajrābhyāsau jyeṣṭhalaghvos tadaikyam</b>  <b>hrasvam laghvor āhatiś ca prakṛtyā/</b>  <b>kṣuṇṇā jyeṣṭhābhyāsayug jyeṣṭhamūlam</b>  <b>tatrābhyāsaḥ kṣepayoḥ kṣepakaḥ syāt//42//</b>  <b>hrasvam vajrābhyāsayor antaram vā</b>  <b>laghvor ghāto yaḥ prakṛtyā vinighnaḥ/</b>  <b>ghāto yaś ca jyeṣṭhayos tadviyogo</b>  <b>jyeṣṭham kṣepo 'trāpi ca kṣepaghātaḥ//43//<sup>146</sup></b>  <b>iṣṭavargahrtaḥ kṣepaḥ kṣepaḥ syād iṣṭabhājite/</b>  <b>mūle te sto 'thavā kṣepaḥ kṣuṇṇaḥ kṣuṇṇe tadā pade//44//<sup>147</sup></b>  <b>iṣṭavargaparakṛtyor yad vivaram tena vā bhajet/</b>  <b>dvighnam iṣṭam kaniṣṭham tat padaḥ syād ekasamyutau//45//</b>  <b>tato jyeṣṭham ihānantyam bhāvanātas tatheṣṭataḥ/46ab/<sup>148</sup></b> </p>	<p>40</p> <p>41</p> <p>42</p> <p>43</p> <p>44</p> <p>45</p> <p>46ab</p>
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udāharaṇam//E28p0/

<sup>143</sup>bhāskarīye bījagaṇite ] śrībhāskarācāryaviracite bījagaṇite AM, Ø G; kuṭṭakaḥ G ] kuṭṭakādhyāyaḥ AM.

<sup>144</sup>I divide this chapter in two sections, vargaprakṛti and cakravāla, according to the concluding remarks E28p5 and 55p.

<sup>145</sup>tatra ... sūtrāṇi AMG ] Ø TP; sārḍhaṣaḍ vṛttāni AM ] Ø GTP.

<sup>146</sup>jyeṣṭham AMGP ] jyeṣṭo T.

<sup>147</sup>hrtaḥ AMGT ] hataḥ P.

<sup>148</sup>ihānantyam AMGP ] ihānantya T; bhāvanātas TP ] bhāvanābhis AMG.

ko vargo 'ṣṭahataḥ saikaḥ kṛtiḥ syād gaṇakocyatām/  
ekādaśaguṇaḥ ko vā vargaḥ saikaḥ kṛtiḥ sakhe//E28//<sup>149</sup>

E28

prathamodāharaṇe nyāsaḥ/ pra 8/ kṣe 1/ atraikam iṣṭam hrasvaṃ prakalpya jāte mūle sakṣepe ka 1 jye 3 kṣe 1/ eṣāṃ bhāvanārtham nyāsaḥ/

pra 8	ka	1	jye	3	kṣe	1
	ka	1	jye	3	kṣe	1

'vajrābhyāsau jyeṣṭhalaghoḥ' (BG 42a) ityādinā prathamakaniṣṭhadvitīyajyeṣṭhamūlābhyāsaḥ 3/ dvitīyakaniṣṭhaprathamajyeṣṭhamūlābhyāsaḥ 3/ anayor aikyaṃ 6 kaniṣṭhapadaṃ syāt/ kaniṣṭhayor āhatih 1 prakṛtiguṇā 8 jyeṣṭhayor abhyāseṇa 9 anena yutā 17 jyeṣṭhapadaṃ syāt/ kṣepayor āhatih kṣepakaḥ syāt 1/ prānmūla-kṣepānām ebhiḥ saha bhāvanārtham nyāsaḥ/

pra 8	ka	1	jye	3	kṣe	1
	ka	6	jye	17	kṣe	1

bhāvanayā labdhe mūle ka 35 jye 99 kṣe 1/ evaṃ padānām ānantyam//E28p1//<sup>150</sup>

dvitīyodāharaṇe rūpam iṣṭam kaniṣṭham prakalpya tadvargāt prakṛtiguṇāt 11 rūpadvayam apāsyā mūlam jyeṣṭham 3/ atra bhāvanārtham nyāsaḥ/

pra 11	ka	1	jye	3	kṣe	2
	ka	1	jye	3	kṣe	2

prāgval labdhe catuḥkṣepamūle ka 6 jye 20 kṣe 4/ 'iṣṭavargahrtaḥ kṣepaḥ' (BG 44a) ityādinā jāte rūpakṣepamūle ka 3 jye 10 kṣe 1/ atas tulyabhāvanayā vā kaniṣṭhajyeṣṭhamūle jāte ka 60 jye 199 kṣe 1/ evam anantamūlāni//E28p2//<sup>151</sup>

athavā rūpam kaniṣṭham prakalpya jāte pañcakṣepapade ka 1 jye 4 kṣe 5/ atas tulyabhāvanayā mūle ka 8 jye 27 kṣe 25/ 'iṣṭavargahrtaḥ' (BG 44a) ityādinā pañcakam iṣṭam prakalpya jāte rūpakṣepapade ka  $\frac{8}{5}$  jye  $\frac{27}{5}$  kṣe 1/ anayoḥ pūrvamūlābhyāṃ saha bhāvanārtham nyāsaḥ/

pra 11	ka	$\frac{8}{5}$	jye	$\frac{27}{5}$	kṣe	1
	ka	3	jye	10	kṣe	1

bhāvanayā labdhe mūle ka  $\frac{161}{5}$  jye  $\frac{534}{5}$  kṣe 1/ athavā 'hrasvaṃ vajrābhyāsayor antaram' (BG 43a) ityādinā kṛtayā bhāvanayā jāte mūle ka  $\frac{1}{5}$  jye  $\frac{6}{5}$  kṣe 1/ evam anekadhā//E28p3//

'iṣṭavargaprakṛtyor yad vivaraṃ tena vā bhajed' (BG 45ab) ityādinā pakṣāntareṇa pade rūpakṣepe pratipādyete/ tatra prathamodāharaṇe rūpatrayam iṣṭam

<sup>149</sup>kṛtiḥ sakhe GTP ] kṛtirbhavet AM.

<sup>150</sup>kṣe 1 (1st) AM ] kṣe G; prakalpya MG ] prakalpya A; vajrābhyāsau AM ] atra sūtram vajrābhyāsau G; dvitīyakaniṣṭhaprathamajyeṣṭha AM ] dvitīyajyeṣṭhaprathamakaniṣṭha G; 9 anena AM ] anena 9 G.

<sup>151</sup>catuḥkṣepa AM ] catuḥkṣepaka G.



prakalpitam 3/ asya vargaḥ 9/ prakṛtiḥ 8/ anayor antaram 1/ anena dvighnam  
 iṣṭam bhaktaḥ 6 jātam rūpakṣepe kaniṣṭhapadam/ ataḥ pūrvavaj jyeṣṭham 17/ evam  
 dvitīyodāharaṇe 'pi rūpatrayam iṣṭam prakalpya jāte kaniṣṭhajyeṣṭhe 3/ 10/ evam  
 iṣṭavaśāt samāsāntarabhāvanābhyāṃ ca padānām ānanyam//E28p4//<sup>152</sup>  
 iti vargaprakṛtiḥ//E28p5//

### II.6.2 Cakravāla

atha cakravāle karaṇasūtram vṛttacatuṣṭayam/46cdp0/

hrasvajyeṣṭhapadakṣepān bhājyapraṁkṣepabhājakān//46cd//	46cd
kṛtvā kalpyo guṇas tatra tathā prakṛtitaś cyute/	47
guṇavarge prakṛtyone 'thavālpam śeṣakam yathā//47//	
tat tu kṣepahrtaṃ kṣepo vyastaḥ prakṛtitaś cyute/	48
guṇalabdhiḥ padaṃ hrasvam tato jyeṣṭham ato 'sakṛt//48// <sup>153</sup>	
tyaktvā pūrvapadakṣepāṃś cakravālam idaṃ jaguḥ/	49
caturdvyekayutāv evam abhinne bhavataḥ pade//49// <sup>154</sup>	
caturdvikṣepamūlābhyāṃ rūpakṣepārthabhāvanā/50ab/ <sup>155</sup>	50ab

udāharaṇam/E29p0/

kā saptaṣaṣṭigūṇitā kṛtir ekayuktā	E29
kā caikaṣaṣṭinihatā ca sakhe sarūpā/	
syān mūladā yadi kṛtiprakṛtir nitāntam	
tvacetasi pravada tāta tatā latāvat//E29// <sup>156</sup>	

prathamodāharaṇe rūpam kaniṣṭham trayam ṛnakṣepam ca prakalpya nyāsaḥ/  
 pra 67 ka 1 jye 8 kṣe 3/ hrasvam bhājyam jyeṣṭham prakṣepam kṣepakam bhājakam  
 ca prakalpya kuṭṭakārtham nyāsaḥ/ bhā 1 hā 3 kṣe 8/ atra 'harataṣṭe' (BG 33a)  
 iti kṛte jātā vallī  $\begin{bmatrix} 0 \\ 2 \\ 0 \end{bmatrix}$  labdhiguṇau  $\frac{0}{2}$  / 'ūrdhvo vibhājyena' (BG 29c) 'adharo

hareṇa' (BG 29d) iti taṣṭikaraṇe svasvataṣṭau labdhivaiṣamyāt svataṣṭaṇābhyāṃ  
 $\frac{1}{3}$  śuddhau  $\frac{1}{1}$  / 'kṣepataṣṭaṇālābhāḍhyā labdhīḥ' (BG 33cd) iti labdhiguṇau

<sup>152</sup>tena AM ] tana G; iṣṭam prakalpitam MG ] iṣṭum prakalpitam A; antaram 1/ MG ] antam 1/  
 A; kaniṣṭhapadam/ ataḥ ] kaniṣṭhapadamataḥ AM, kaniṣṭham padamataḥ G; dvitīyodāharaṇe 'pi  
 MG ] dvitīyodāharaṇe 'pi A; ānanyam MG ] ānyam A.

<sup>153</sup>guṇalabdhiḥ AGTP ] gaṇalabdhiḥ M.

<sup>154</sup>caturdvyeka AGTP ] cartudvyeka M.

<sup>155</sup>caturdvikṣepa MGTP ] catudvikṣepa A.

<sup>156</sup>nihatā GTP ] guṇitā AM; tatā latāvat AMG ] tatālatāvat TP.

$\frac{3}{1}$  / harasya carṇatvāl labdher ṛṇatve kṛte jātau labdhiguṇau  $\frac{3}{1}$  / guṇasya varge 1 prakṛteḥ śodhite śeṣam 66 alpakaṃ na jātam/ ato rūpadvayam ṛṇam iṣṭam prakalpya ‘iṣṭāhataśvasvahareṇa’ (BG 36a) ityādinā jātau labdhiguṇau  $\frac{5}{7}$  / atra guṇavarge 49 prakṛter viśodhite śeṣam 18/ kṣepeṇa 3 hṛtam labdham 6/ ayam kṣepaḥ/ guṇavarge prakṛter viśodhite vyastāḥ syād iti dhanam 6/ labdhiḥ kaniṣṭham padam 5/ asyarnatve dhanatve cottare karmaṇi na viśeṣo ’stīti jātam dhanam 5/ asya varge prakṛtiguṇe śadyute jātam mūlam jyeṣṭham 41//E29p1//<sup>157</sup>

punar eṣām kuṭṭakārtham nyāsaḥ/ bhā 5 hā 6 kṣe 41/ vallī 

0
1
41
0

 ato labdhi-

guṇau  $\frac{11}{5}$  / guṇavarge 25 prakṛteś cyute śeṣe 42 kṣepeṇa 6 hṛte 7 ‘vyastāḥ prakṛtitaś cyute’ (BG 48b) iti jātaḥ kṣepaḥ  $\frac{7}{1}$  / labdhiḥ kaniṣṭham 11/ ato jyeṣṭham 90//E29p2//<sup>158</sup>

punar eṣām kuṭṭakārtham nyāsaḥ/ bhā 11 hā 7 kṣe 90/ atra ‘harataṣṭe dhanakṣepe’ (BG 33a) iti kṛte jāto guṇaḥ 5/ labdhayo viṣamā iti takṣaṇaśuddho jāto guṇaḥ 2/ asya kṣepaḥ 7/ ṛṇarūpeṇa 1 guṇitam kṣepam 7 guṇe prakṣipya jāto guṇaḥ 9/ asya varge prakṛtyone śeṣam 14 kṣepeṇa 7 hṛtvā jātaḥ kṣepaḥ  $\frac{2}{1}$  / labdhiḥ kaniṣṭham 27/ ato jyeṣṭham 221//E29p3//<sup>159</sup>

ābhyām tulyabhāvanārtham nyāsaḥ/

ka	27	jye	221	kṣe	$\frac{2}{1}$
ka	27	jye	221	kṣe	$\frac{2}{1}$

uktavan mūle ka 11934 jye 97684 kṣe 4/ catuḥkṣepapadena 2 anena bhakte jāte rūpakṣepamūle ka 5967 jye 48842 kṣe 1//E29p4//<sup>160</sup>

dvitīyodāharaṇe nyāsaḥ/ pra 61 ka 1 jye 8 kṣe 3/ kuṭṭakārtham nyāsaḥ/ bhā 1 hā 3 kṣe 8/ ‘harataṣṭe dhanakṣepe’ (BG 33a) iti labdhiguṇau  $\frac{3}{1}$  / ‘iṣṭāhata’ (BG 36a) iti dvābhyām utthāpya jātau labdhiguṇau  $\frac{5}{7}$  / guṇavarge 49 prakṛteḥ śodhite 12 ‘vyastāḥ’ (BG 48b) ity ṛṇam  $\frac{12}{1}$  / idaṃ kṣepahrtaṃ jātaḥ kṣepaḥ  $\frac{4}{1}$  / ataḥ prāgvaj

<sup>157</sup>pra 67 ka 1 jye 8 kṣe  $\frac{3}{1}$  ] pra 67 kṣe 1/ ka 1 jye 8 kṣe  $\frac{3}{1}$  AMG; bhā 1 hā 3 kṣe 8/ ] bhā 1 hā  $\frac{3}{1}$  kṣepaḥ 8/ A, bhā 1 hā 3 kṣepaḥ 8/ M, bhā.  $\frac{1}{hā. 3/}$  kṣe. 8/ G; lābhādhyā MG ] lādhyā A; harasya ca AM ] harasya G; labdher ṛṇatve ] labdhe ṛṇatve AM, labdheḥ ṛṇatve G; viśodhite (twice) MG ] viśodhite A; kaniṣṭham padam AM ] kaniṣṭhapadam G; asyarnatve dhanatve cottare karmaṇi na viśeṣo ’stīti jātam dhanam 5/ MG(asya ṛṇatve, ca uttare) ] ∅ A.

<sup>158</sup>bhā 5 hā 6 kṣe 41/ AM ] bhā<sup>o</sup>  $\frac{5}{hā. 6}$  kṣe<sup>o</sup> 41/ G; śeṣe AM ] śeṣam G.

<sup>159</sup>bhā 11/ hā  $\frac{7}{1}$  kṣe 90/ AM ] bhā<sup>o</sup> 11/ kṣe<sup>o</sup> 90/ G; 5 MG ] 2 A.  
hā<sup>o</sup>  $\frac{7}{1}$

<sup>160</sup>padena ] pade AMG.

jāte catuḥkṣepamūle ka 5 jye 39 kṣe 4//E29p5//<sup>161</sup>

‘iṣṭavargahrtaḥ kṣepaḥ kṣepaḥ syāt’ (BG 44ab) ity upapannarūpaśuddhimūlayor  
bhāvanārthaṃ nyāsaḥ/

ka	$\frac{5}{2}$	jye	$\frac{39}{2}$	kṣe	$\frac{4}{2}$
ka	$\frac{5}{2}$	jye	$\frac{39}{2}$	kṣe	$\frac{4}{2}$

ato bhāvanayā jāte rūpakṣepamūle ka  $\frac{195}{2}$  jye  $\frac{1523}{2}$  kṣe 1//E29p6//<sup>162</sup>  
anayoḥ punā rūpaśuddhipadābhyāṃ bhāvanārthaṃ nyāsaḥ/

ka	$\frac{5}{2}$	jye	$\frac{39}{2}$	kṣe	$\frac{4}{2}$
ka	$\frac{195}{2}$	jye	$\frac{1523}{2}$	kṣe	1

ato jāte rūpaśuddhau mūle ka 3805 jye 29718 kṣe 1/ anayos tulyabhāvanayā jāte  
rūpakṣepamūle ka 226153980 jye 1766319049 kṣe 1//E29p7//<sup>163</sup>

atha rūpaśuddhau khilatvajñānaprakārāntaritamānayanayoḥ karaṇasūtraṃ  
vṛttadvayam/50cdp0/

**rūpaśuddhau khiloddiṣṭaṃ vargayogo guṇo na cet//50cd//**

50cd

**akhile kṛtimūlābhyāṃ dvidhā rūpaṃ vibhājitam/**

51

**dvidhā hrasvapadaṃ jyeṣṭhaṃ tato rūpaviśodhane//51//<sup>164</sup>**

**pūrvavad vā prasādhyete pade rūpaviśodhane/52ab/**

52ab

udāharaṇam/E30p0/

**trayodaśaguṇo vargo nirekaḥ kaḥ kṛtir bhavet/**

E30

**ko vāṣṭaguṇito vargo nireko mūlado vada//E30//<sup>165</sup>**

atra prakṛtir dvikatrikayor vargayor yogāḥ 13/ ato dvikena rūpaṃ hrtaṃ rūpa-  
śuddhau kaniṣṭhaṃ padaṃ  $\frac{1}{2}$  syāt/ asya vargāt prakṛtiguṇād ekonān mūlaṃ  
jyeṣṭhaṃ  $\frac{3}{2}$  / athavā trikeṇa rūpaṃ hrtaṃ kaniṣṭhaṃ  $\frac{1}{3}$  syāt/ ato jyeṣṭhaṃ  
 $\frac{2}{3}$  //E30p1//<sup>166</sup>

<sup>161</sup>pra 61 ka 1 jye 8 kṣe 3/ kuṭṭakārthaṃ nyāsaḥ/ AM ] ∅ G; bhā 1 hā 3 kṣe 8/ AM ]  
bhā. 1/ kṣe. 8/ G; kṣepahrtaṃ AM ] kṣepa-6-hṛtaṃ G; kṣe 4 G ] ∅ AM.  
hā. 3/

<sup>162</sup>kṣepaḥ kṣepaḥ G ] kṣepaḥ AM; ato bhāvanayā AM ] anayoḥ G.

<sup>163</sup>kṣe 1 (2nd) AG ] ∅ M; kṣe 1 (2nd) G ] ∅ AM.

<sup>164</sup>rūpaviśodhane AMGP ] rūpaviśodhanam T.

<sup>165</sup>vargo (twice) AMGP ] vargaḥ T.

<sup>166</sup>padaṃ  $\frac{1}{2}$  syāt AM ] padaṃ syāt  $\frac{1}{2}$  G; jyeṣṭhaṃ  $\frac{3}{2}$  AM ] jyeṣṭhaṃ padaṃ  $\frac{3}{2}$  G; kaniṣṭhaṃ  
 $\frac{1}{3}$  syāt AM ] kaniṣṭhaṃ syāt  $\frac{1}{2}$  G.

athavā kaniṣṭham 1/ asya vargāt prakṛtiguṇāc caturūnān mūlaṃ jyeṣṭham 3/ krameṇa nyāsaḥ/ ka 1 jye 3 kṣe 4/ 'iṣṭavargahṛtaḥ kṣepaḥ' (BG 44a) ityādinā jāte rūpaśuddhau pade ka  $\frac{1}{2}$  jye  $\frac{3}{2}$  kṣe 1/ athavā prakṛter nava tyaktvaivam eva jāte ka  $\frac{1}{3}$  jye  $\frac{2}{3}$  kṣe 1//E30p2//<sup>167</sup>

cakravālenābhinne vā/ eṣāṃ hrasvajyeṣṭhapadakṣepāṇāṃ bhinnānāṃ 'hrasvajyeṣṭhapadakṣepān' (BG 46c) ityādinā 'bhājyaparakṣepabhājakān' (BG 46d) prakalpya pūrvapadayor nyāsaḥ/ bhā  $\frac{1}{2}$  hā 1 kṣe  $\frac{3}{2}$  / atra bhājyabhājakakṣepān ardhēnāpavartya jātāḥ bhā 1 hā 2 kṣe 3/ 'harataṣṭe' (BG 33a) iti kuṭṭakena guṇalabdhi  $\frac{1}{2}$  atreṣṭam ṛṇaṃ rūpaṃ prakalpya jāto 'nyo guṇaḥ 3/ 'guṇavarge' (BG 47c) ityādinā kṣepaḥ 4/ labdhīḥ 3 kaniṣṭham/ ato jyeṣṭham 11/ krameṇa nyāsaḥ/ ka 3 jye 11 kṣe 4/ ato 'pi punar 'bhājyaparakṣepabhājakān' (BG 46d) ityādinā cakravālena labdho guṇaḥ 3/ 'guṇavarge' (BG 47c) ityādinā rūpaśuddhāv abhinne pade ka 5 jye 18 kṣe 1/ iha sarvatra padānāṃ rūpakṣepapadābhyāṃ bhāvanayānāntyam//E30p3//<sup>168</sup>

evaṃ dvitīyodāharaṇe prakṛtiḥ 8/ prāgvaj jāte hrasvajyeṣṭhapade ka  $\frac{1}{2}$  jye 1 kṣe 1//E30p4//<sup>169</sup>

udāharaṇam/E31p0/

**ko vargaḥ ṣaḍguṇas tryādhya dvādaśādhya 'thavā kṛtiḥ/  
yuto vā pañcasaptatyā trīśatyā vā kṛtir bhavet//E31//**

E31

atra rūpaṃ hrasvaṃ kṛtvā nyāsaḥ/ pra 6 ka 1 jye 3 kṣe 3/ atra 'kṣepaḥ kṣuṇṇaḥ kṣuṇṇe tadā pade' (BG 44cd) iti dviguṇite jāte dvādaśakṣepe 2/ 6/ pañcaguṇe pañcasaptatimite kṣepe 5/ 15/ daśaguṇe jāte trīśatikṣepe 10/ 30//E31p//<sup>170</sup>

athechchayānītapadayo rūpakṣepapadānayanadarśane karaṇasūtraṃ sārḍha-  
vṛttam/52cdp0//<sup>171</sup>

<sup>167</sup>kṣe 4 G ] kṣe 4 AM; ka  $\frac{1}{2}$  jye  $\frac{3}{2}$  kṣe 1 ] ka  $\frac{1}{2}$  jye  $\frac{3}{2}$  AM, ka  $\frac{1}{3}$  jye  $\frac{2}{3}$  kṣe 1 G; tyaktvaivam eva G ] tyaktvevameva AM; ka  $\frac{1}{3}$  jye  $\frac{2}{3}$  kṣe 1 ] ka  $\frac{1}{3}$  jye  $\frac{2}{3}$  AM, ka  $\frac{1}{2}$  jye  $\frac{1}{2}$  kṣe 1 G.

<sup>168</sup>bhā  $\frac{1}{2}$  hā 1 kṣe  $\frac{3}{2}$  AM ] bhā.  $\frac{1}{2}$  kṣe.  $\frac{3}{2}$ / G; bhā 1 hā 2 kṣe 3 AM ] bhā. 1/ kṣe. 3/ G; hā. 1 hā. 2

guṇalabdhi G ] guṇalabdhi AM;  $\frac{1}{2}$  ]  $\frac{1}{2}$  AMG; ṛṇaṃ rūpaṃ A ] ṛṇarūpaṃ MG; 3 kaniṣṭham/ ato ]

3 kaniṣṭhamato AM, 3 ato G; kṣe 1 G ] ∅ AM.

<sup>169</sup>kṣe 1 G ] ∅ AM.

<sup>170</sup>atra MG ] atha A.

<sup>171</sup>athechchayā AG ] athechchāyā M; padayo G ] padayoh AM; kṣepapadānāyana AM ] kṣepadānāyana G; karaṇa G ] ∅ AM.

svabuddhyaiva pade jñeye bahukṣepaviśodhane//52cd// 52cd  
 tayor bhāvanayānantyaṃ rūpakṣepapadotthayā/ 53  
 vargacchinne guṇe hrasvaṃ tatpadena vibhājayet//53//

udāharaṇam/E32p0/

**dvātriṃśadguṇito vargaḥ kaḥ saiko mūlado vada//E32//<sup>172</sup>** E32

nyāsaḥ/ pra 32/ ataḥ prāgvat kaniṣṭhajyeṣṭhe  $\frac{1}{2}$  / 3/ athavā ‘vargacchinne guṇe hrasvaṃ tatpadena vibhājayet’ (BG 53cd) iti prakṛtiḥ 32 catuśchinnā labdham 8/ asyāṃ prakṛtau kaniṣṭhajyeṣṭhe 1/ 3/ yena vargeṇa 4 prakṛtiś chinnā tasya padena 2 kaniṣṭhe bhakte jāte te eva pade ka  $\frac{1}{2}$  jye 3//E32p//<sup>173</sup>

atha vargarūpāyāṃ prakṛtau bhāvanāvvyatirekeṇānekapadānāyane karaṇasūtraṃ vṛttam/54p0/

**iṣṭabhakto dvidhā kṣepa iṣṭonāḍhyo dalīkṛtaḥ/ 54  
 guṇamūlahṛtaś cādyo hrasvajyeṣṭhe kramāt pade//54//**

udāharaṇam/E33p0/

**kā kṛtir navabhiḥ kṣuṇṇā dvipañcāsadyutā kṛtiḥ/ E33  
 ko vā caturguṇo vargas trayastriṃśadyutaḥ kṛtiḥ//E33//<sup>174</sup>**

atra prathamodāharaṇe kṣepaḥ 52/ dvikeneṣṭena hr̥to dviṣṭhaḥ/ ‘iṣṭonāḍhyo dalīkṛtaḥ’ (BG 54b) jātaḥ 12/ 14/ anayor ādyaḥ prakṛtimūlena bhakto jāte hrasvajyeṣṭhe 4/ 14/ athavā kṣepaṃ caturbhir vibhajyaivaṃ jāte hrasvajyeṣṭhe  $\frac{3}{2}$  /  $\frac{17}{2}$  //E33p1//<sup>175</sup>

dvitīyodāharaṇe kṣepam 33/ ekeneṣṭena vibhajyaivaṃ jāte hrasvajyeṣṭhe 8/ 17/ tribhir jāte 2/ 7//E33p2//

athavā prakṛtisamakṣepa udāharaṇam/E34p0/

**trayodaśaguṇo vargaḥ kas trayodaśavarjitaḥ/ E34  
 trayodaśayuto vā syād varga eva nigadyatām//E34//<sup>176</sup>**

<sup>172</sup>There is no Anuṣṭubh hemistich to be coupled with this.

<sup>173</sup>te eva M ] ta eva AG.

<sup>174</sup>pañcāsadyutā AMGP ] pañcāsadyutā T; triṃśadyutaḥ AMG ] triṃśadyutā T, triṃśadyutā P.

<sup>175</sup>dviṣṭhaḥ MG ] diṣṭhaḥ A;  $\frac{3}{2}$  /  $\frac{17}{2}$  ]  $\frac{3}{2}$  /  $\frac{17}{2}$  AG,  $\frac{3}{5}$  /  $\frac{17}{5}$  M.

<sup>176</sup>vargaḥ kas TP ] vargas AMG; varjitaḥ TP ] vivarjitaḥ AMG.

prathamodāharaṇe prakṛtiḥ 13/ jāte kaniṣṭhajyeṣṭhe 1/ 0/ atra 'iṣṭavarga-  
prakṛtyor yad vivaram' (BG 45ab) ityādinā rūpakṣepamūle  $\frac{3}{2}$  /  $\frac{11}{2}$  / ābhyāṃ  
bhāvanayā trayodaśarṇakṣepamūle  $\frac{11}{2}$  /  $\frac{39}{2}$  / vaiṣāṃ ṛṇakṣepapadānāṃ rūpa-  
śuddhipadābhyāṃ ābhyāṃ  $\frac{1}{2}$  /  $\frac{3}{2}$  viśleṣyamāṇabhāvanayā trayodaśakṣepamūle  
 $\frac{3}{2}$  /  $\frac{13}{2}$  / vā 18/ 65//E34p//<sup>177</sup>  
udāharaṇam/E35p0/

**ṛṇagaiḥ pañcabhiḥ kṣuṇṇaḥ ko vargaḥ saikaviṃśatiḥ/** E35  
**vargaḥ syād vada ced vetsi kṣayagaprakṛtau vidhim//E35//<sup>178</sup>**

nyāsaḥ/ pra 5/ atra jāte mūle 1/ 4/ vā 2/ 1/ rūpakṣepabhāvanayānantyam  
//E35p//

**uktaṃ bījopayogīdaṃ saṃkṣiptaṃ gaṇitaṃ kila/** 55  
**ato bījaṃ pravakṣyāmi gaṇakānandakārakam//55//**

iti bhāskariye bījagaṇite vargaprakṛticakravālaḥ samāptaḥ//55p//<sup>179</sup>

## II.7 Ekavarṇa-samīkaraṇa

athaikavarṇasamīkaraṇam//56p0//<sup>180</sup>

**yāvattāvat kalpyam avyaktarāśer** 56  
**mānaṃ tasmin kurvatoddiṣṭam eva/**  
**tulyau pakṣau sādhanīyau prayatnāt**  
**tyaktvā kṣiptvā vāpi saṃguṇya bhaktvā//56//**  
**ekāvyaaktaṃ śodhayed anyapakṣād** 57  
**rūpāṇy anyasyetarasmāc ca pakṣāt/**  
**śeṣāvyaktenoddhared rūpaśeṣaṃ**  
**vyaktaṃ mānaṃ jāyate 'vyaktarāśeḥ//57//<sup>181</sup>**  
**avyaktānāṃ dvyādikānāṃ apīha** 58  
**yāvattāvad dvyādinighnaṃ hr̥taṃ vā/**  
**yuktonaṃ vā kalpayed ātmabuddhyā**

<sup>177</sup>viśleṣyamāṇabhāvanayā AMG ] viśeṣasamabhāvanayā T(K)P(K).

<sup>178</sup>kṣuṇṇaḥ GTP ] kṣuṇṇaḥ AM.

<sup>179</sup>bhāskariye ] śribhāskara AM, śribhāskariye G; vargaprakṛti AM ] ∅ G; vālaḥ samāptaḥ AM ]  
vālaṃ samāptam G.

<sup>180</sup>athaikavarṇasamīkaraṇam/ AM ] ∅ G.

<sup>181</sup>ekāvyaaktaṃ AGTP ] ekāvyaaktaṃ M; ca AGTP ] cā M.

**mānaṃ kvāpi vyaktam evaṃ viditvā//58//**

prathamam ekavarṇasamīkaraṇaṃ bījam/ dvitīyam anekavarṇasamīkaraṇaṃ bījam/ yatra varṇasya dvayor vā bahūnāṃ varṅādigatānāṃ samīkaraṇaṃ tan madhyamāharaṇaṃ/ yatra bhāvitasya samīkaraṇaṃ tad bhāvitam iti bījacatuṣṭayaṃ vadanty ācāryāḥ//58p1//<sup>182</sup>

tatra prathamam tāvad ucyate/ pṛcchakena pṛṣṭe saty udāharaṇe yo 'vyaktarāśis tasya mānaṃ yāvattāvad ekaṃ dvyādi vā prakalpya tasminn avyaktarāśāv uddeśakālāpavat sarvaṃ guṇanabhajanatrairāśikapañcarāśikaśreḍhīphalakṣetravyavahārādi gaṇakena kāryam/ tathā kurvātā dvau pakṣau prayatnena samau kāryau/ yady ālāpe samau pakṣau na stas tadaikatāre nyūne pakṣe kiṃcit prakṣipya tato 'dhikapakṣāt tāvad eva viśodhya vā nyūnaṃ pakṣaṃ kenacit saṃguṇya vādhikaṃ pakṣaṃ tāvataiva bhaktvā samau kāryau/ tatas tayor ekasya pakṣasyāvyaktam anyapakṣasyāvyaktāc chodhyam avyaktavargādikam api/ anyapakṣarūpāñītarapakṣarūpebhyaḥ śodhyāni/ yadi karaṇyaḥ santi tadā tā apy uktaparakāreṇa śodhyāḥ/ tato 'vyaktarāśiśeṣeṇa rūpaśeṣe bhakte yal labhyate tad ekasyāvyaktasya mānaṃ vyaktaṃ jāyate/ tena kalpito 'vyaktarāśir utthāpyaḥ//58p2//<sup>183</sup>

yatrodāharaṇe dvyādayo 'vyaktarāśayo bhavanti tadā tasyaikaṃ yāvattāvat prakalpyānyeṣāṃ dvyādibhir iṣṭair guṇitaṃ bhaktaṃ veṣṭai rūpair ūnaṃ yutaṃ vā yāvattāvad eva kalpyam//58p3//<sup>184</sup>

athavaikasya yāvattāvad anyeṣāṃ vyaktāny eva mānāni prakalpyāni/ 'evaṃ viditvā' (BG 58d) iti/ yathā kriyā nirvahati tathā buddhimatā jñātvā śeṣānāṃ avyaktāni vyaktāni vā kalpyānīty arthaḥ//58p4//<sup>185</sup>

udāharaṇam/E36p0/

**ekasya rūpatriśatī ṣaḍ aśvā**

E36

**aśvā daśānyasya tu tulyamaulyāḥ/**

**ṛṇaṃ tathā rūpaśataṃ ca tasya**

**tau tulyavittau ca kim aśvamaulyam//E36//<sup>186</sup>**

**yad ādyavittasya dalam dviyutaṃ**

E37

**tattulyavitto yadi vā dvitīyaḥ/**

<sup>182</sup>bhāvitasya samīkaraṇaṃ G ] bhāvitasya AM.

<sup>183</sup>dvyādi G ] dvyādiṃ AM; śreḍhīphalakṣetravyavahārādi AM ] śreṇīkṣetrādikam G; samau pakṣau AM ] pakṣau samau G; tato 'dhikapakṣāt tāvad eva viśodhya ... tāvataiva bhaktvā AM ] tatas tyaktvā vā kenacitsaṃguṇya bhaktvā vā G; tadā tā apy uktaparakāreṇa AM ] tadoktaparakāreṇa G.

<sup>184</sup>yutaṃ AM ] yuktaṃ G; kalpyam AM ] prakalpyam G.

<sup>185</sup>prakalpyāni AM ] prakalpāni G; evaṃ GT(K)P(K) ] sarvaṃ AM; kalpyānīty arthaḥ AG ] kalpyānātyarthaḥ M.

<sup>186</sup>maulyāḥ TP ] mūlyāḥ AMG; maulyam TP ] mūlyam AMG.

**ādya dhanena triguṇo 'nyato vā  
pṛthak pṛthañ me vada vājimaulyam//E37//<sup>187</sup>**

atrāśvamaulyam ajñātam/ tasya mānaṃ yāvattāvad ekaṃ prakalpitaṃ yā 1/  
tatra trairāśīkam/ yady ekasya yāvattāvan mūlyam tadā ṣaṇṇām kim iti/ phalam  
icchāguṇaṃ pramāṇabhaktaṃ labdham ṣaṇṇām aśvānām mūlyam yā 6/ atra rūpa-  
śatatrāye prakṣipte jātam ādyasya dhanam yā 6 rū 300/ evaṃ daśānām maulyam  
yā 10/ atra rūpaśate carṇagate prakṣipte jātaṃ dvitīyasya dhanam yā 10 rū 100/  
etau samadhanāv iti pakṣau svata eva samau jātau/ samaśodhanārthaṃ nyāsaḥ/

$$\begin{array}{|c|c|c|c|} \hline yā & 6 & rū & 300 \\ \hline yā & 10 & rū & 100 \\ \hline \end{array}$$

atha 'ekāvvyaktaṃ śodhayed anyapakṣāt' (BG 57a) ity ādyapakṣāvvyakte 'nya-  
pakṣāvvyaktāc chodhite śeṣam yā 4/ dvitīyapakṣarūpeṣv ādyapakṣarūpebhyaḥ  
śodhiteṣu śeṣam rū 400/ avyaktarāśīśeṣeṇa yā 4 rūpaśeṣe rū 400 uddhr̥te labd-  
ham ekasya yāvattāvato mānaṃ vyaktaṃ 100/ yady ekāśvasyedaṃ maulyam tadā  
ṣaṇṇām kim iti trairāśīkena labdham ṣaṇṇām maulyam 600/ rūpaśatatrāyayutaṃ  
900 jātam ādyasya dhanam/ evaṃ dvitīyasyāpi 900//E37p1//<sup>188</sup>

atha dvitīyodāharaṇe prathamadvitīyayos te eva dhane

$$\begin{array}{|c|c|c|c|} \hline yā & 6 & rū & 300 \\ \hline yā & 10 & rū & 100 \\ \hline \end{array}$$

atrādyapakṣadhanārdhena diviyuktena tulyam anyasya dhanam udāhṛtam/ ata  
ādyaadhanārdhe diviyute 'thavānyadhane divihīne diviguṇe kṛte pakṣau samau  
bhavataḥ/ tathā kṛte śodhanārthaṃ nyāsaḥ/

$$\begin{array}{|c|c|c|c|} \hline yā & 3 & rū & 152 \\ \hline yā & 10 & rū & 100 \\ \hline \end{array} \text{ athavā } \begin{array}{|c|c|c|c|} \hline yā & 6 & rū & 300 \\ \hline yā & 20 & rū & 204 \\ \hline \end{array}$$

ubhayaor api śodhanādye kṛte labdham yāvattāvanmānam 36/ anena pūrvavad  
utthāpane kṛte jāte dhane 516/ 260//E37p2//<sup>189</sup>

atha tṛtīyodāharaṇe te eva dhane/ atrādyadhanatryaṃśaḥ paradhanam iti paraṃ  
triguṇīkṛtya nyāsaḥ/

$$\begin{array}{|c|c|c|c|} \hline yā & 6 & rū & 300 \\ \hline yā & 30 & rū & 300 \\ \hline \end{array}$$

<sup>187</sup>A places E37 between E37p1 and E37p2 with the introductory phrase, 'dvitīyodāharaṇam.'  
maulyam AMTP ] mūlyam G.

<sup>188</sup>maulyam (here and hereafter) AM ] mūlyam G; kim iti (1st) AM ] kimiti nyāsaḥ  
pra. pha° i°  
1/ yā 1/ 6/ G; yā 4 (2nd) MG ] yā 4 A; uddhr̥te G ] uddhate AM; ekāśvasyedaṃ AM  
] ekasyāśvasyedaṃ G.

<sup>189</sup>te eva MG ] ta eva A; diviyute AM ] diviyukte G.



samakriyayā labdham yāvattāvanmānam 25/ anenotthāpīte jāte dhane 450/  
150//E37p3//<sup>190</sup>  
udāharaṇam/E38p0/

**māṇikyāmalanīlamauktikamītiḥ pañcāṣṭa sapta kramād**  
**ekasyānyatarasya sapta nava ṣaṭ tadratnasamkhyā sakhe/**  
**rūpāṇām navatir dviṣaṣṭir anayos tau tulyavittau tathā**  
**bījajña pratiratnajāni sumate maulyāni śīghram vada//E38//<sup>191</sup>**

E38

atrāvvyaktānām bahutve kalpitāni māṇikyādīnām maulyāni yā 3/ yā 2/ yā 1/ yady  
ekasya ratnasyedaṃ maulyaṃ tadoddiṣṭānām kim iti labdhānām yāvattāvatām yoge  
svasvarūpayute jātāu pakṣau

yā	38	rū	90
yā	45	rū	62

ete anayor dhane iti samaśodhane kṛte labdham yāvattāvanmānam 4/ anenot-  
thāpitāni māṇikyādīnām maulyāni 12/ 8/ 4/ evaṃ sarvadhanam 242//E38p1//<sup>192</sup>

athavā māṇikyamānam yāvattāvan nīlamuktāphalayor maulye vyakte eva kalpīte  
5/ 3/ ataḥ samīkaraṇena labdham yāvattāvanmānam 13/ anenotthāpīte jātāṃ sama-  
dhanam 216/ evaṃ kalpanāvaśād anekadhā//E38p2//  
udāharaṇam/E39p0/

**eko bravīti mama dehi śataṃ dhanena**  
**tvatto bhavāmi hi sakhe dviguṇas tato 'nyaḥ/**  
**brūte daśārpayasi cen mama ṣaḍguṇo 'haṃ**  
**tvattas tayor vada dhane mama kiṃpramāṇe//E39//<sup>193</sup>**

E39

atra kalpīte ādyadhane

yā	2	rū	100
yā	1	rū	100

anayoḥ parasya śate gṛhīta ādyo dviguṇitaḥ syād ity ekālāpo ghaṭate/ athādyād  
daśāpanīya daśabhiḥ paradhanam yutaṃ ṣaḍguṇam syād ity ādyam ṣaḍguṇīkṛtya  
nyāsaḥ/

yā	12	rū	660
yā	1	rū	110

<sup>190</sup>te eva MG ] ta eva A; atrādyā AM ] ādyā G; samakriyayā MG ] samakriyayā A; jāte dhane 450  
AM ] jāte 450 G.

<sup>191</sup>pratiratnajāni AMP ] pratiratnajāti GT.

<sup>192</sup>

yā	38	rū	90
yā	45	rū	62

 ] 

yā	15	yā	16	yā	7	rū	90
yā	21	yā	18	yā	6	rū	62

 | AMG; sarvadhanam AG ]  
sarmadhanam M.

<sup>193</sup>kiṃpramāṇe MP ] kiṃ pramāṇe AGT.

ataḥ samīkaraṇena labdhaṃ yāvattāvanmānam 70/ anenothāpīte jāte dhane 40/  
170//E39p//<sup>194</sup>  
udāharaṇam/E40p0/

**māṇikyāṣṭakam indranīladaśakam muktāphalānām śatam** E40  
**yat te karṇavibhūṣaṇe samadhanam krītam tvadarthe mayā/  
tadratnatrayamaulyasaṃyutimitis tryūnam śatārdham priye  
maulyam brūhi pṛthag yadīha gaṇite kalyāsi kalyāṇini//E40//<sup>195</sup>**

atra samadhanam yāvattāvāt 1/ yadāṣṭānām māṇikyānām idaṃ maulyam  
tadaikasya kim ity evamtrairāśikena sarvatra maulyāni yā  $\frac{1}{8}$  / yā  $\frac{1}{10}$  / yā  $\frac{1}{100}$  /  
eṣāṃ yogaḥ saptacatvāriṃśatā sama iti samaśodhanārtham nyāsaḥ/

$$\begin{array}{|c|c|c|c|} \hline yā & 47 & rū & 0 \\ \hline yā & 200 & rū & 0 \\ \hline yā & 0 & rū & 47 \\ \hline \end{array}$$

etau pakṣau samacchedīkṛtya chedagame samīkaraṇena labdhaṃ yāvattāvanmānam  
200/ anenothāpītāni jātāni ratnamaulyāni 25/ 20/ 2/ samadhanam 200/ evaṃ  
karṇabhūṣaṇe ratnamaulyam 600//E40p1//<sup>196</sup>

atra samacchedīkṛtya śodhanārtham ādyapakṣeṇa parapakṣe hriyamāṇe che-  
dāṃśaviparyāse kṛte parasya chedo guṇo 'mśo haraś ceti tulyatvāt tayor nāśo bha-  
vatīti chedagamaḥ kriyate//E40p2//<sup>197</sup>

udāharaṇam/E41p0/

**pañcāṃśo 'likulāt kadambam agamat tryaṃśaḥ śilīndhram tayor** E41  
**viśleṣas triguṇo mṛgākṣi kuṭajaṃ dolāyamāno 'paraḥ/  
kānte ketakamālatīparimalaprāptaikakālapriyā-  
dūtāhūta itas tato bhramati khe bhṛṅgo 'liṣaṃkhyāṃ vada//  
E41//<sup>198</sup>**

atrālikulapramāṇam yāvattāvāt 1/ ataḥ kadambādīgatālipramāṇam yāvattāvāt  
 $\frac{14}{15}$  / etad dṛṣṭena bhramareṇa yutam alipramāṇam iti nyāsaḥ/

$$\begin{array}{|c|c|c|c|} \hline yā & 14 & rū & 1 \\ \hline yā & 15 & rū & 1 \\ \hline yā & 1 & rū & 0 \\ \hline \end{array}$$

<sup>194</sup>660 ] 360 AM, 600 G.

<sup>195</sup>indranīla AGTP ] indranāla M; kalyāsi AMG ] kalpāsi TP.

<sup>196</sup>tadaikasya G ] tadekasya AM;  $\frac{1}{8}$  MG ]  $\frac{1}{4}$  A.

<sup>197</sup>bhavatīti AM ] bhaviṣyatīti G.

<sup>198</sup>viśleṣas AMGPL ] viśleṣat T; kuṭajaṃ dolāyamāno AMGTPL(ASS) ] kuṭaje dolāyamāno L(VIS);  
priyā AMGL ] priyāda T, priyād PT(cor); dūtāhūta itas tato AMGTPL(ASS) ] nirdhūtaḥ paritah  
sthitō L(VIS); saṃkhyāṃ AMGPL ] saṃkhyā T.

etau samacchedīkrtya chedagame pūrvaval labdhaṃ yāvattāvanmānam 15/ etad ali-  
pramāṇam//E41p//<sup>199</sup>

athānyoktam apy udāharaṇam kriyālāghavārthaṃ pradarśyate/E42p0/

**pañcakaśatadattadhanāt phalasya vargaṃ viśodhya pariśiṣṭam/  
dattaṃ daśakaśatena tulyaḥ kālaḥ phalaṃ ca tayoḥ//E42//<sup>200</sup>**

E42

atra kāle yāvattāvat kalpīte kriyā na nirvahaṭīty ataḥ kalpitāḥ pañca māsāḥ/  
mūladhanaṃ yāvattāvat 1/ asmāt pañcarāśīke nyāsaḥ/

$$\begin{array}{|c|c|} \hline 1 & 5 \\ \hline 100 & yā 1 \\ \hline 5 & \\ \hline \end{array}$$

labdhaṃ phalaṃ yā  $\frac{1}{4}$  / asya vargaḥ yāva  $\frac{1}{16}$  / mūladhanāt samacchedena śodhite  
jātaṃ dvitīyamūladhanam yāva  $\frac{1}{16}$  yā 16 / atrāpi māsapañcakena pañcarāśīke kṛte  
nyāsaḥ/

$$\begin{array}{|c|c|} \hline 1 & 5 \\ \hline 100 & yāva \frac{1}{16} yā 16 \\ \hline 10 & \\ \hline \end{array}$$

labdhaṃ phalam yāva  $\frac{1}{32}$  yā 16 / etat pūrvaphalasyāsyā yā  $\frac{1}{4}$  samam iti pakṣau  
yāvattāvatāpavartya samaśodhanārthaṃ pakṣayor nyāsaḥ/

$$\begin{array}{|c|c|} \hline yā \frac{1}{32} & rū 16 \\ \hline yā 0 & rū \frac{1}{4} \\ \hline \end{array}$$

prāgval labdhaṃ yāvattāvanmānam 8/ etan mūladhanaṃ//E42p1//<sup>201</sup>

athavā prathamapramāṇaphalena dvitīyapramāṇaphale vibhakte yal labhya-  
te tadguṇaḡuṇitena dvitīyamūladhanena tulyam eva prathamamūladhanaṃ syāt/

<sup>199</sup>yā  $\frac{14}{15}$  rū 1 (in the table) AM ] yā  $\frac{16}{15}$  rū 15 G.

<sup>200</sup>viśodhya MGTP ] viśovya A.

<sup>201</sup>pañcarāśīke G ] pañcarāśīkena AM;  $\begin{array}{|c|c|} \hline 1 & 5 \\ \hline 100 & yā 1 \\ \hline 5 & \\ \hline \end{array}$  A(here and hereafter without enclo-

sure) ]  $\begin{array}{|c|c|} \hline 1 & 5 \\ \hline 100 & yā 1 \\ \hline 5 & 0 \\ \hline \end{array}$  M,  $\frac{1}{5} \mid \frac{5}{0}$  G; yāva  $\frac{1}{16}$  yā 16 AG ] yāva  $\frac{1}{16}$  yā 16 M;

$\begin{array}{|c|c|} \hline 1 & 5 \\ \hline 100 & yāva \frac{1}{16} yā 16 \\ \hline 10 & \\ \hline \end{array}$  AM(here and hereafter without enclosure) ]  $\frac{1}{100} \mid \frac{5}{0}$  G;

samaśodhanārthaṃ AM ] samaśodhanāya G;  $\begin{array}{|c|c|} \hline yā \frac{1}{32} & rū 16 \\ \hline yā 0 & rū \frac{1}{4} \\ \hline \end{array}$  AM ]  $\frac{1}{yā \frac{1}{32}} \mid \frac{5}{rū 16}$  G.

katham anyathā same kāle samaṃ phalaṃ syāt/ ato dvitīyasyāyaṃ guṇaḥ 2/ ekaguṇaṃ dvitīyamūladhanam ekonaguṇaguṇitaṃ phalavarge vartate/ ata ekonaguṇeneṣṭakalpitakalāntarasya varge bhakte dvitīyamūladhanaṃ syāt/ etat phalavargayutaṃ prathamamūladhanaṃ syāt//E42p2//<sup>202</sup>

atra kalpitaphalavargaḥ 4/ ataḥ prathamadvitīyamūladhane 8/ 4/ phalam 2/ yadi śatasya pañca kalāntaraṃ tadāṣṭānāṃ kim iti labdham ekamāse 'ṣṭānāṃ phalam  $\frac{2}{5}$  / yady anenaiko māsas tadā dvikena kim iti labdhā māsāḥ 5//E42p3//<sup>203</sup> udāharaṇam/E43p0/

**ekakaśatadattadhanāt phalasya vargaṃ viśodhya pariśiṣṭam/ E43**  
**pañcakaśatena dattaṃ tulyaḥ kālaḥ phalaṃ ca tayoḥ//E43//<sup>204</sup>**

atra guṇakaḥ 5/ ekonaguṇena 4 iṣṭaphalasya varge 16 bhakte jātaṃ dvitīyadhanam 4/ idaṃ phalavargayutaṃ jātaṃ prathamadhanam 20/ ato 'nupātadvayena kālaḥ 20//E43p1//<sup>205</sup>

evaṃ svabuddhyaivedaṃ sidhyati kiṃ yāvattāvatkalpanayā/ athavā buddhir eva bījam/ tathā ca gole mayoktam/

**'naiva varṇātmakaṃ bījaṃ na bījāni pṛthak pṛthak/ Q2**  
**ekam eva matir bījam analpā kalpanā yataḥ'//Q2//<sup>206</sup>**

//E43p2//

udāharaṇam/E44p0/

**māṇikyāṣṭakam indranīladaśakaṃ muktāphalānāṃ śataṃ E44**  
**sadvajrāṇi ca pañca ratnavāṇijāṃ yeṣāṃ caturṇāṃ dhanam/**  
**saṃgasnehavaśena te nijadhanād dattvaikam ekaṃ mitho**  
**jātās tulyadhanāḥ pṛthag vada sakhe tadratnamaulyāni me//**  
**E44//<sup>207</sup>**

atra yāvattāvadādayo varṇā avyaktānāṃ mānāni kalpyanta ity upalakṣaṇam/ tannāmāṅkitāni kṛtvā samīkaraṇaṃ kāryaṃ matimadbhiḥ/ tad yathā/ anyonyam ekaikaṃ ratnaṃ dattvā samadhanā jātās teṣāṃ mānāni

<sup>202</sup>ekaguṇaṃ AM ] ∅ G.

<sup>203</sup>atra AM ] ataḥ G.

<sup>204</sup>ekaka AMGT ] eka P; pañcaka AMGP ] ṣaṃcaka T.

<sup>205</sup>iṣṭaphalasya A ] iṣṭaphalasyāsyā MG.

<sup>206</sup>Cited from GA, praśna 5. varṇātmakaṃ MG, SS ] varṇātmikaṃ A.

<sup>207</sup>nijadhanād AMGPL ] nijadhanā T; dattvaikam AMGPL(ASS) ] datvaikam TL(VIS); sakhe AMGPL ] sarave T; maulyāni AMGTP ] mūlyāni L.

mā	5	nī	1	mu	1	va	1
mā	1	nī	7	mu	1	va	1
mā	1	nī	1	mu	97	va	1
mā	1	nī	1	mu	1	va	2

samānām samakṣepe samaśuddhau samataiva syād ity ekaikaṃ māṇikyādiratnaṃ  
pṛthak pṛthag ebhya viśodhya śeṣāṇi samāny eva jātāni mā 4/ nī 6/ mu 96/ va 1/ yad  
ekasya vajrasya maulyaṃ tad eva māṇikyacatuṣṭayasya tad eva nīlaṣaṭkasya tad eva  
muktāphalānām saṅṅavateḥ/ ata iṣṭaṃ samadhanam prakalpya pṛthag ebhiḥ śeṣair  
vibhajya maulyāni labhyante/ tathā kalpiteṣṭena 96 jātāni maulyāni māṇikyādīnām  
24/ 16/ 1/ 96//E44p//<sup>208</sup>

udāharaṇam/E45p0/

**pañcakaśatena dattaṃ mūlaṃ sakalāntaraṃ gate varṣe/  
dviguṇaṃ ṣoḍaśahīnaṃ labdhaṃ kiṃ mūlam ācakṣva//E45//<sup>209</sup>**

E45

atra mūladhanaṃ yāvattāvat 1/ atah pañcarāśikena

1	12
100	yā 1
5	

kalāntaraṃ yā  $\frac{3}{5}$  / etan mūlayutaṃ jātam yā  $\frac{8}{5}$  / dviguṇamūladhanasya ṣoḍaśa-  
hīnasya yā 2 rū  $\overset{\bullet}{16}$  samam iti karaṇena

yā	2	rū	$\overset{\bullet}{16}$
yā	$\frac{8}{5}$	rū	0

labdhaṃ mūlam 40/ kalāntaraṃ ca 24//E45p//<sup>210</sup>

udāharaṇam/E46p0/

**yat pañcakadvikacatuṣkaśatena dattaṃ  
khaṇḍais tribhir navatīyuk triśatī dhanam tat/  
māseṣu saptadaśapañcasu tulyam āptaṃ  
khaṇḍatraye 'pi saphalaṃ vada khaṇḍasaṃkhyām//E46//<sup>211</sup>**

E46

mā	5	nī	1	mu	1	va	1
nī	7	mā	1	mu	1	va	1
mu	97	mā	1	nī	1	va	1
va	2	mā	1	nī	1	mu	1

<sup>208</sup>table AM ]

G; tad eva (2nd) G ] ∅ AM; ebhiḥ MG ]

ebhi A.

<sup>209</sup>kiṃ mūlam ācakṣva GTP ] mūlam samācakṣva AM.

<sup>210</sup>yāvattāvat 1 G ] yāvat 1 AM; pañcarāśikena MG ] pañcarāśikena A;  $\left[ \begin{array}{cc} 1 & 12 \\ 100 & yā 1 \\ 5 & \end{array} \right]$  ]  $\frac{1}{5}$   $\frac{12}{yā}$

A,  $\frac{1}{100}$   $\frac{12}{yā 1}$  M,  $\frac{1}{100}$   $\frac{12}{yā 1}$  G;  $\frac{8}{5}$  (1st) AM ]  $\frac{5}{8}$  G; ṣoḍaśahīnasya AM ] ṣoḍaśonasya G;  
karaṇena AM ] samīkaraṇena G.

<sup>211</sup>navatīyuk AMGT(cor)P ] bhavatiyuk T; traye 'pi AMGP ] trayopi T; saphalaṃ AMTP ]  
saphalām G.

atra saphalasya khaṇḍasya samadhanasya pramāṇam yāvattāvāt 1/ yady ekena māsenā pañca phalaṃ śatasya tadā māsasaptakena kim iti labdham śatasya phalaṃ 35/ etac chate prakṣipyā jātā 135/ yady asya saphalasya śataṃ mūlaṃ tadā yāvattāvanmitasya saphalasya kim iti labdham prathamakhaṇḍapramāṇam yā  $\frac{20}{27}$  / punar yadi māsenā dvau phalaṃ śatasya tadā daśabhir māsaḥ kim ityādyukta-prakāreṇa dvitīyakhaṇḍam yā  $\frac{5}{3}$  / evaṃ tṛtīyam yā  $\frac{5}{3}$  / eṣāṃ aikyam yā  $\frac{65}{27}$  / sarvadhanasyāśya 390 samaṃ kṛtvāptayāvattāvanmānena 162 anenotthāpitāni khaṇḍāni 120/ 135/ 135/ sakalāntaraṃ samam etat 162//E46p//<sup>212</sup>  
udāharaṇam/E47p0/

**purapraveśe daśado dviṣaṅguṇam  
vidhāya śeṣaṃ daśabhuk ca nirgame/  
dadau daśaivaṃ nagaratraye 'bhavat  
trinighnam ādyaṃ vada tat kiyad dhanam//E47//<sup>213</sup>**

E47

atra dhanam yā 1/ asyālāpavat sarvaṃ kṛtvā puratrayanivṛttāu jātāṃ dhanam yā 8 rū  $\frac{280}{\cdot}$ / etad ādyasya triguṇitasya yā 3 samaṃ kṛtvāptam yāvattāvanmānam 56//E47p//<sup>214</sup>  
udāharaṇam/E48p0/

**sārdham taṇḍulamānakatrayam aho drammeṇa mānāṣṭakam  
mudgānāṃ ca yadi trayodaśamitā etā vaṇik kākīṇīḥ/  
ādāyārpaya taṇḍulāṃśayugalaṃ mudgaikabhāgānvitam  
kṣipraṃ kṣiprabhujo vrajema hi yataḥ sārtho 'grato yāsyati//  
E48//<sup>215</sup>**

E48

atra taṇḍulamānam yā 2/ mudgamānam yā 1/ yadi sārdhamānatrayeṇaiko drammo labhyate tadānena yā 2 kim iti labdham taṇḍulamaulyam yā  $\frac{4}{7}$  / yadi mānāṣṭakenaiko drammas tadānena yā 1 kim iti labdham mudgamaulyam yā  $\frac{1}{8}$  / anayor yogaḥ yā  $\frac{39}{56}$  trayodaśakākīṇīsama iti drammajātyā  $\frac{13}{64}$  sāmyakaraṇāl labdham yāvattāvanmānam  $\frac{7}{24}$  / anenotthāpīte taṇḍulamudgamūlye  $\frac{1}{6}$  /  $\frac{7}{192}$  /

<sup>212</sup>saphalasya (1st) AM ] phalasya G;  $\frac{5}{3}$  (twice) AM ]  $\frac{5}{6}$  G; kṛtvāpta ] kṛtvā AMG; anenotthāpitāni AM ] utthāpitāni G; 162 MG ] 136 A.

<sup>213</sup>daśabhuk ca AMGP ] daśabhukta T.

<sup>214</sup> $\frac{280}{\cdot}$  AG ] 280 M.

<sup>215</sup>aho AMGTPL(ASS) ] iha L(VIS); ca AMGTPL(ASS) ] tu L(VIS); vaṇik MGTPL ] vaṇikt A; taṇḍulāṃśa AMGTL ] tandulāṃśa P; yataḥ AMGTL(ASS) ] yutaḥ P, vāyam L(VIS).

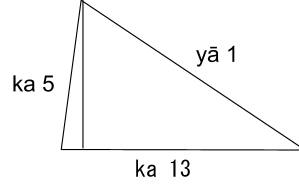
taṇḍulamudgamānabhāgās ca  $\frac{7}{12}$  /  $\frac{7}{24}$  //E48p//<sup>216</sup>  
udāharaṇam/E49p0/

**svārdhapañcāmsānavamair yuktāḥ ke syuḥ samās trayāḥ/** E49  
**anyāmsādvayahīnā ye ṣaṣṭiśeṣās ca tān vada//E49//<sup>217</sup>**

atra samarāśimānaṃ yāvattāvat 1/ ato vilomavidhinā ‘atha svāmsādhikone’ (L 49a) ityādinā rāśayaḥ yā  $\frac{2}{3}$  / yā  $\frac{5}{6}$  / yā  $\frac{9}{10}$  / ihānyabhāgadvayenonāḥ sarve ‘py evaṃ śeṣāḥ syuḥ yā  $\frac{2}{5}$  / etat ṣaṣṭisamaṃ kṛtvāptayāvattāvanmānena 150 utthāpitā jātā rāśayaḥ 100/ 125/ 135//E49p//<sup>218</sup>  
udāharaṇam/E50p0/

**trayodaśa tathā pañca karaṇyau bhujayor mitī/** E50  
**bhūr ajñātā ca catvāraḥ phalaṃ bhūmiḥ vadāsu me//E50//<sup>219</sup>**

atra bhūmer yāvattāvatkalpane kriyā prasaratīti svecchayā tryasre ka 13 bhūmiḥ kalpyate phalaviśeṣābhāvāt/ ato ‘tra kalpitaṃ tryasram/ nyāsaḥ/



atra

**‘lambagaṇaṃ bhūmyardhaṃ spaṣṭaṃ tribhuje phalaṃ bhavati’**  
**(L 166)**

iti vyatyayena phalāl lambo jātaḥ ka  $\frac{64}{13}$  / etadvargaṃ bhujakaraṇīṣ vargāt rū 5  
asmād apāsyā rū  $\frac{1}{13}$  / mūlaṃ jātāvādhā ka  $\frac{1}{13}$  / imāṃ bhūmer apāsyā ‘yogaṃ  
karaṇyor mahatīm prakalpya’ (BG 13a) iti jātānyāvādhā ka  $\frac{144}{13}$  / asyā vargāt  
rū  $\frac{144}{13}$  lambavarga rū  $\frac{64}{13}$  yutāt rū  $\frac{208}{13}$  mūlaṃ jāto bhujāḥ 4/ iyam eva

<sup>216</sup>yā 2 (1st) AM ] yāvattāvat 2 G; tadānena yā 2 G ] tadā yā 2 anena AM; tadānena yā 1 G ] tadā yā 1 anena AM.

<sup>217</sup>hīnā ye P ] hīnāśca AMG, hīnāye T.

<sup>218</sup>svāmsādhikone AM(-na ity...) ] svāmsādhikonena G;  $\frac{9}{10}$  AM ]  $\frac{6}{10}$  G; dvayenonāḥ AM ] dvayonāḥ G.

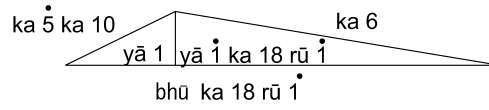
<sup>219</sup>karaṇyau GTP ] karaṇyo AM; ajñātā ca AMG ] ajñātā T, ajñātātra P; bhūmiḥ AMGP ] bhūmi T.

bhūmiḥ//E50p//<sup>220</sup>  
udāharaṇam/E51p0/

daśapañcakaraṇyantaram eko bāhuḥ paraś ca ṣaṭkaraṇī/  
bhūr aṣṭādaśakaraṇī rūponā lambam ācakṣva//E51//<sup>221</sup>

E51

atrāvādhājñāne lambajñānam iti laghvāvādhā yā 1/ etadūnā bhūr anyāvādhā-  
pramāṇam iti/ tathā nyāsaḥ/



svāvādhāvargaṇ svabhujavargād apāsyā jāto lambavargaḥ yāva 1 rū 15 ka 200/  
dvitīyāvādhāvargaṇ yāva 1 yā ka 72 yā 2 rū 19 ka 72 svabhujavargāt rū 6 apāsyā jāto  
dvitīyo lambavargaḥ yāva 1 yā 2 yā ka 72 rū 13 ka 72/ etau samāv iti samaśodhane  
kṛte jātau pakṣau

rū	28	ka	512
yā	2	yā ka	72

atra bhājakasyāvyaktaśeṣasya yākārasya prayojanābhāvād apagame kṛte bhājya-  
bhājakau jātau/

rū	28	ka	512
rū	2	ka	72

atra

‘dhanarṇatāvyatyayam īpsitāyāś chede karaṇyā asakṛd vidhāya’  
(BG 16)

iti dvisaptatimitakarāṇyā dhanatvaṇ prakalpya ka 4 ka 72/ anyā bhājye guṇite  
jātam ka 36864 ka 3136 ka 56448 ka 2048/ etāsv etayoḥ ka 36864 ka 3136 mūle

<sup>220</sup>svicchāyā G ] svecchāyā AM; ka 13 AG ] 13 M; ato 'tra MG ] atro 'tra A; nyāsaḥ/ (Fig.) atra  
lambaguṇam A ] (Fig.) nyāsaḥ/ atra lambaguṇam M, nyāsaḥ/ atra lambaguṇam (Fig.) G; phalāl  
lambo MG ] phalallambo A; bhujakaraṇī5 vargāt G ] bhujā-5-karaṇīvargāt AM; asmād AM ] ∅ G;  
prakalpya MG ] prakvalpya A; rū  $\frac{64}{13}$  AM ] rū  $\frac{64}{16}$  G; mūlam (2nd) AM ] malam G.

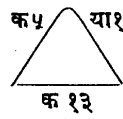


Fig. BGE50p-1a:

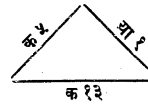


Fig. BGE50p-1g:

<sup>221</sup>lambam GTP ] lambamānam (Gīti meter) AM.



192/ 56/ anayor yogah rū 136/ śeṣakaraṇyor anayoh ka 56448 ka 2048 antaram  
yoga iti jāto yogah ka 36992/ bhājake ca ka 4624/ anayā bhājye hrte labdham  
yāvattāvanmānam rū 2 ka 8/ iyam eva laghvāvādhā/ etadūnā bhūr anyāvādhā rū  
1 ka 2/ yāvattāvanmānena lambavargāv utthāpya svāvādhāvargam svabhujavargād  
apāsya vā jāto lambavargah rū 3 ka 8/ etasya mūlasamam eva lambamānam rū 1  
ka 2//E51p//<sup>222</sup>

udāharaṇam/E52p0/

**asamānasamacchedān rāśims tāms caturo vada/  
yadaikyam yadghanaikyam vā yeṣām vargaikyasammitam//  
E52//<sup>223</sup>**

E52

atra rāśayah yā 1/ yā 2/ yā 3/ yā 4/ eṣām yogah yā 10 vargayogenānena yāva  
30 sama iti pakṣau yāvattāvatāpavartya nyāsaḥ/

$$\begin{array}{|c|c|c|c|} \hline yā & 30 & rū & 0 \\ \hline yā & 0 & rū & 10 \\ \hline \end{array}$$

samaśodhanādinā prāgvallabdhayāvattāvanmānenotthāpitā rāśayah  $\frac{1}{3} / \frac{2}{3} / \frac{3}{3} /$   
 $\frac{4}{3}$  //E52p1//<sup>224</sup>

atha dvitīyodāharaṇe rāśayah yā 1/ yā 2/ yā 3/ yā 4/ eṣām ghanaikyam  
yāgha 100/ etad vargaikyamānena yāva 30 samam iti pakṣau yāvattāvadvargeṇā-  
pavartya prāgvallabdhayāvattāvanmānenotthāpitā jātā rāśayah  $\frac{3}{10} / \frac{6}{10} / \frac{9}{10} /$   
 $\frac{12}{10}$  //E52p2//<sup>225</sup>

udāharaṇam/E53p0/

<sup>222</sup>yā 1 MG ] yā A; tathā nyāsaḥ/ (Fig.) M ] tathā— nyāsaḥ— (Fig.) A, tathā (Fig.) nyāsaḥ G;  
ka 5 ka 10 (in figure) AM ] ka 10 ka 5 G; yā 1 (in figure) AM ] ∅ G; yā 1 ka 18 rū 1 (in figure)  
AM ] ∅ G; bhū ka 18 rū 1 (in figure) ] bhū = ka 18 rū 1 AM, ka 18 rū 1 G; svabhujavargād (1st)  
AM ] bhujavargād G; 512 (1st table) AM ] 152 G; 2nd table ] ∅ AM, rū 28 ka 152 G;  
rū 2 ka 72

īpsitāyāś chede karaṇyā asakṛd vidhāya iti AM ] īpsitāyāḥ— ityādinā G; 36864 (1st) G ] 36864 AM;  
svāvādhāvargam (2nd) G ] svāvādhāvargam AM.

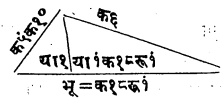


Fig. BGE51p-1a:

Fig. BGE51p-1g:



<sup>223</sup>cchedān rāśims AMT(cor)P ] prajña rāśims G, a variant mentioned by Kṛṣṇa, cchedānrāśims  
T.

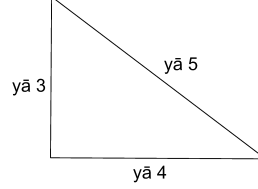
<sup>224</sup>eṣām AM ] yeṣām G.

<sup>225</sup>yā 2/ yā 3/ MG ] yā 3/ yā 2/ A; yāgha 100 AG ] yāva 100 M; yāvattāvadvargeṇā G ] yāvadvargeṇā  
AM.

tryasrakṣetrasya yasya syāt phalaṃ karṇena sammitam/  
doḥkoṭīśrutighātena samam yasya ca tad vada//E53//

E53

nyāsaḥ/



atreṣṭakṣetrabhujānām yāvattāvadguṇitānām nyāsaḥ/ yā 3/ yā 4/ yā 5/ atra  
ca bhujakoṭīghātārdhaṃ phalam yāva 6/ etat karṇenānena yā 5 samam iti pakṣau  
yāvattāvātāpavartya prāgval labdhena yāvattāvanmānenotthāpitā jātā bhujakoṭi-  
karṇāḥ  $\frac{5}{2} / \frac{10}{3} / \frac{25}{6} /$  evam iṣṭavaśād anye 'pi//E53p1//<sup>226</sup>

atha dvitīyodāharaṇe kalpitaṃ tad eva kṣetram/ yasya phalam yāva 6/ etad  
doḥkoṭīkarṇaghātenānena yāgha 60 samam iti pakṣau yāvattāvadvargenāpavartya  
samīkaraṇena prāgvaj jātā doḥkoṭīkarṇāḥ  $\frac{3}{10} / \frac{2}{5} / \frac{1}{2} /$  evam iṣṭavaśād anye  
'pi//E53p2//<sup>227</sup>

udāharaṇam/E54p0/

yutau vargo 'ntare vargo yayor ghāte ghano bhavet/  
tau rāśī śīghram ācakṣva dakṣo 'si gaṇite yadi//E54//<sup>228</sup>

E54

atra rāśī yāva 4/ yāva 5/ yoge 'ntare ca yathā vargaḥ syāt tathā kalpi-  
tau/ atrānayor ghātaḥ yāvava 20/ eṣa ghana itīṣṭayāvattāvaddaśakasya gha-  
nena samīkaraṇe pakṣau yāvattāvadghanenāpavartya prāgvaj jātau rāśī 10000/  
12500//E54p//<sup>229</sup>

udāharaṇam/E55p0/

ghanaikyam jāyate vargo vargaikyam ca yayor ghanaḥ/  
tau ced vetsi tadāham tvam manye bijavidam varam//E55//

E55

<sup>226</sup>nyāsaḥ/ (1st) AM ] ∅ G;

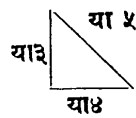
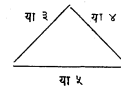


Fig. BGE53p-1a:

Fig. BGE53p-1g:



<sup>227</sup>yasya AM ] asya G; yāvattāvadvargenā G ] yāvadvargenā AM;  $\frac{3}{10} / \frac{2}{5} /$  AM ]  $\frac{2}{5} / \frac{3}{10} /$  G.

<sup>228</sup>ghāte AMGT(cor)P ] dhāte T.

<sup>229</sup>yāva 4/ yāva 5/ ] yāva 5/ yāva 4/ AMG.

atra kalpitau rāśī yāva 1/ yāva 2/ anayor ghanayogaḥ yāvagha 9/ eṣa svayam eva vargo jātaḥ/ asya mūlam yāgha 3//E55p1//

nanu yāvattāvadvargaghano 'yaṃ rāśir na ghanavargaḥ/ katham asya ghanātmakaṃ mūlam iti ced ucyate/ yāvān eva ghanavargas tāvān eva vargaghanaḥ syād ity ata eva dvigatacaturgataṣaḍgatāṣṭagatā vargāḥ syuḥ/ eṣāṃ ekadvitricaturgatāni mūlāni yathākramaṃ syuḥ/ evaṃ triṣaṇṇavagatā ghanāḥ/ ekadvitrigatāni teṣāṃ mūlāni/ evaṃ sarvatra jñātavyam//E55p2//<sup>230</sup>

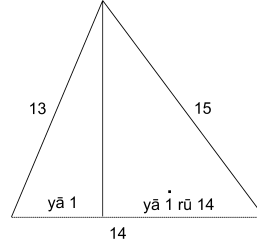
atha rāśyor vargayogaḥ yāvava 5/ yaṃ ghana itīṣṭayāvattāvattapañcaghana-samaṃ kṛtvā pakṣau yāvattāvadvghanenāpavartya prāgvaj jātau rāśī 625/ 1250/ evam avyaktāpavartanam yathā saṃbhavati tathā cintyam//E55p3//<sup>231</sup>

udāharaṇam/E56p0/

**yatra tryasrakṣetre dhātrī manusammitā sakhe bāhū/  
ekaḥ pañcadaśānyas trayodaśa vadāvalambakaṃ tatra//E56//<sup>232</sup>**

E56

āvādhājñāne sati lambajñānam iti laghvāvādhā yāvattāvanmitā kalpitā yā 1/ etadūnā caturdaśānyāvādhā yā 1 rū 14/ nyāsaḥ/



svāvādhāvargonau svabhujavargau samāv iti samaśodhanārthaṃ nyāsaḥ/

yāva	1	yā	0	rū	169
yāva	1	yā	28	rū	29

anayoḥ samavargagame labdham yāvattāvanmānam 5/ anenotthāpīte āvādhe 5/ 9/ lambavargayoś cotthāpitayor ubhayataḥ sama eva lambaḥ 12/ atrotthāpanaṃ vargasya vargeṇa ghanasya ghanenaiveti sudhiyā jñātavyam//E56p//<sup>233</sup>

udāharaṇam/E57p0/

<sup>230</sup>ṣaḍgatāṣṭagatā MG ] ṣaḍgatāṣṭagatā A.

<sup>231</sup>prāgvaj jātau MG ] prāgvajātau A.

<sup>232</sup>tryasrakṣetre AMG ] tryasre kṣetre TP.

<sup>233</sup>etadūnā AM ] etadūnās G; svabhujavargau AM ] svabhujavargau tau G.

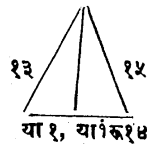


Fig. BGE56p-1a:

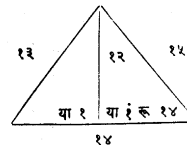
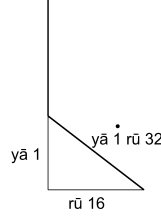


Fig. BGE56p-1g:

yadi samabhuvi veṇur dvitripāṇipramāṇo  
gaṇaka pavanavegād ekadeśe sa bhagnaḥ/  
bhuvi nṛpamitahasteṣv aṅga lagnaṃ tadagraṃ  
kathaya katiṣu mūlād eṣa bhagnaḥ kareṣu //E57//<sup>234</sup>

E57

atra vaṃśādharakhaṇḍaṃ koṭiḥ/ tatpramāṇam yā 1/ etadūnā dvātrimśad  
ūrdhvakhaṇḍaṃ karṇaḥ yā 1 rū 32/ mūlāgrayor antaraṃ bhujāḥ rū 16/ nyāsaḥ/



bhujakoṭivargayogaḥ yāva 1 rū 256/ karṇavargasyāsyā yāva 1 yā 64 rū 1024 sama  
iti samavargagame prāgvadāptayāvattāvanmānena 12 utthāpitau koṭikarṇau 12/ 20/  
evaṃ bhujakoṭiyutāv api//E57p//<sup>235</sup>

atra koṭikarṇāntare bhuje ca jñāta udāharaṇam/E58p0/<sup>236</sup>

cakrakrauñcākulitasalile kvāpi dr̥ṣṭaṃ taḍāge  
toyād ūrdhvaṃ kamalakalikāgraṃ vitastipramāṇam/  
mandaṃ mandaṃ calitam anilenāhataṃ hastayugme  
tasmin magnaṃ gaṇaka kathaya kṣipram ambupramāṇam//  
E58//<sup>237</sup>

E58

atra nalapramāṇam jalagāmbhīryam iti tatpramāṇam yā 1/ iyaṃ koṭiḥ/ sā kalikā-  
mānayutā jātaḥ karṇaḥ yā 2 rū 1 / hastadvayaṃ bhujāḥ rū 2/ nyāsaḥ/

<sup>234</sup>dvitri AMGTP(LASS) ] danta L(VIS); sa bhagnaḥ AMGTL ] subbhagnaḥ P; aṅga lagnaṃ AMGTP(LASS) ] eva lagnaḥ L(VIS); tadagraṃ AMTPL ] tadyaṃ G.

<sup>235</sup>ūrdhvaṃ khaṇḍaṃ karṇaḥ yā 1 rū 32 G ] ūrdhvakhaṇḍaṃ yā 1 rū 32 karṇaḥ AM; rū 16 AM ] rū 12 G; rū 16 (in figure) AM ] 16 G.

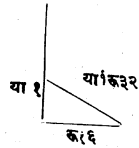


Fig. BGE57p-1a:

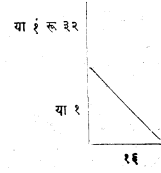
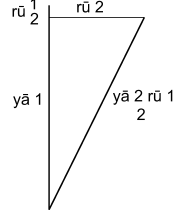


Fig. BGE57p-1g:

<sup>236</sup>atra AM ] atha G; jñāta G ] jñāte AM.

<sup>237</sup>cakra AMGTP(LASS) ] cañcat L(VIS); krauñcākulita GTP(LASS) ] kroñcākulita AM; taḍāge GTP(LASS) ] taḍāge AM, taḍāke L(VIS); calitam anilenāhataṃ AMGTP(LASS) ] calitapavanenāhataṃ L(VIS); kathaya MTPL ] gaṇaya AG; ambu GTP ] ambhaḥ AML.

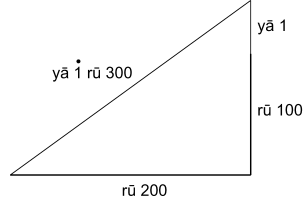


atrāpi doḥkoṭivargayogaṃ karṇavargasamaṃ kṛtvā labdham jalagāmbhīryam  
 $\frac{15}{4}$  / karṇamānam  $\frac{17}{4}$  //E58p//<sup>238</sup>  
 udāharaṇam/E59p0/

**vṛkṣād dhastaśatocchrayāc chatayuge vāpīm kapiḥ ko 'py agād  
 uttīryātha paro drutaṃ śrutipathāt proḍḍīya kiṃcid drumāt/  
 jātaivaṃ samatā tayor yadi gatāv uḍḍīnamānam kiyad  
 vidvaś cet supariśramo 'sti gaṇite kṣipraṃ tad ācakṣva me//  
 E59//<sup>239</sup>**

E59

atra samagatiḥ 300/ uḍḍīnamānam yā 1/ etadyuto vṛkṣocchrāyaḥ koṭiḥ/  
 yāvattāvadūnā samagatiḥ karṇaḥ/ taruvāpyantaram bhujāḥ/ nyāsaḥ/



bhujakoṭivargaikyam karṇavargasamaṃ kṛtvā labdham uḍḍīnamānam  
 50//E59p//<sup>240</sup>

<sup>238</sup> yā  $\frac{2}{2}$  rū 1 AM ] yā 1 rū  $\frac{1}{2}$  G; bhujāḥ rū 2 AM ] bhujāḥ 2 G; nyāsaḥ/ (Fig.) atrāpi ...  
 karṇavargasamaṃ A ] (Fig.) atrāpi ... karṇavargasamaṃ M, nyāsaḥ atrāpi ... karṇavargasamaṃ  
 (Fig.) G; rū  $\frac{1}{2}$  (in figure) AM ]  $\frac{1}{2}$  G; rū 2 (in figure) AM ] 2 G; yā  $\frac{2}{2}$  rū 1 (in figure) AM ]  
 ∅ G.

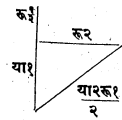


Fig. BGE58p-1a:

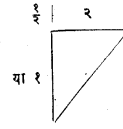


Fig. BGE58p-1g:

<sup>239</sup> vṛkṣād MGTPL ] vṛddhād A; śatocchrayāc MGTPL ] śatoca yāc A; vāpīm AMGTPL(ASS)  
 ] vāpyām L(VIS); uttīryātha AMGTPL(ASS) ] uḍḍīyātha L(VIS); śrutipathāt proḍḍīya  
 AMGTPL(VIS) ] śrutipathenoḍḍīya L(ASS); yadi gatāv uḍḍīna AMGL(ASS) ] yadi gatāv uḍḍīya  
 TP, yutirapi proḍḍīya L(VIS); vidvaś cet supariśramo AMGTPL(ASS) ] vidvan vetsi pariśramo  
 L(VIS).

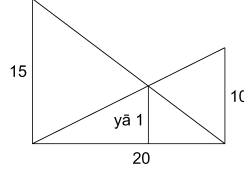
<sup>240</sup> yā 1 AM ] yāvattāvat 1 G; nyāsaḥ/ (Fig.) bhujā ... 50// AM ] bhujā ... 50// nyāsaḥ (Fig.) G;  
 yā 1 rū 300 (in figure) M ] yām 1 rū 300 A, ∅ G; rū 100 (in figure) AM ] 100 G; rū 200 (in figure)

udāharaṇam/E60p0/

pañcadaśadaśakarocchrayaveṇvor ajñātamadhyabhūmikayoḥ/  
itaretaramūlāgragasūtrayuter lambamānam ācaḡṣva//E60//<sup>241</sup>

E60

atra kriyāvataranārtham iṣṭam veṇvantarabhūmānam kalpitam 20/ sūtra-  
sāmpātāl lambamānam yā 1/ nyāsaḥ/



yadi pañcadaśakoṭyā viṃśatir bhujas tadā yāvattāvanmitakoṭyā kim iti labdhā  
laghuvamśāsritāvādhā yā  $\frac{4}{3}$  / punar yadi daśamitakoṭyā viṃśatir bhujas tadā  
yāvattāvanmitakoṭyā kim iti bṛhadvamśāsritāvādhā yā 2/ anayor yogam yā  $\frac{10}{3}$   
viṃśatisamaṃ kṛtvā labdho lambaḥ 6/ utthāpanenāvādhē ca 8/ 12//E60p1//<sup>242</sup>

athavā vamśasaṃbandhenāvādhē tadyutir bhūmir iti yadi vamśadvayayogena 25  
anenāvādhāyogo 20 labhyate tadā vamśābhyāṃ 15/ 10/ kim iti jāte āvādhē 12/ 8/  
atrānupātāt sama eva lambaḥ 6/ kiṃ yāvattāvatkalanayā//E60p2//<sup>243</sup>

athavā vamśayor vadho yogahrto yatra kutrāpi vamśāntare lambaḥ syād iti kiṃ  
bhūmikalanayāpi/ etad bhūvi sūtrāṇi prasārya buddhimatohyam//E60p3//  
iti bhāskarīye bījagaṇita ekavarṇasamīkaraṇam samāptam//E60p4//<sup>244</sup>

AM ] 200 G; karṇavargasamaṃ AM ] karṇasamaṃ G.

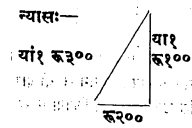


Fig. BGE59p-1a:

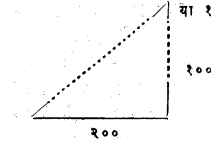


Fig. BGE59p-1g:

<sup>241</sup>karocchraya AMGTL ] karocchrāya P; madhyabhūmikayoḥ AMGTPL(ASS) ] bhūmi-  
madhyakayoḥ L(VIS); lambamānam AMGTPL(ASS) ] lambam L(VIS).

<sup>242</sup>atra ... yā 1/ nyāsaḥ/ (Fig.) yadi M ] (Fig.) atra ... yā 1/ nyāsaḥ/ yadi A, atra ... yā 1 (Fig.)  
nyāsaḥ yadi G; 20 (in figure) AM ]  $\emptyset$  G; yā 1 (in figure) G ]  $\emptyset$  AM; yāvattāvanmitakoṭyā (twice) G  
] yāvanmitakoṭyā AM; viṃśatir (2nd) AM ] viṃśati G.

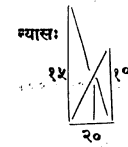


Fig. BGE60p-1a:

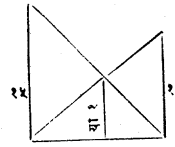


Fig. BGE60p-1g:

<sup>243</sup>25 anenāvādhā AM ] anena 25 āvādhā G; 12/ 8/ ] 8/ 12/ AMG.

<sup>244</sup>bhāskarīye ] śrībhāskarīya AM, śrībhāskarīye G; gaṇita G ] gaṇite AM.

## II.8 Ekavarṇa-madhyamāhararāṇa

athaikavarṇamadhyamāhararāṇam//59p1//<sup>245</sup>

athāvyaktavargādisamīkaraṇam/ tac ca madhyamāhararāṇam iti vyāvarṇayanty  
ācāryāḥ/ yato 'tra vargarāśāv ekasya madhyamasyāhararāṇam iti/ atra sūtram  
ṛttatrayam/59p0/<sup>246</sup>

<p><b>avyaktavargādi yadāvaśeṣam</b> <b>pakṣau tadeṣṭena nihatyā kiṃcit/</b> <b>kṣepyaṃ tayor yena padapradāḥ syād</b> <b>avyaktapakṣo 'sya padena bhūyaḥ//59//<sup>247</sup></b> <b>vyaktasya mūlasya samakriyaivam</b> <b>avyaktamānaṃ khalu labhyate tat/</b> <b>na nirvahaś ced ghanavargavargeṣv</b> <b>evaṃ tadā jñeyam idaṃ svabuddhyā//60//<sup>248</sup></b> <b>avyaktamūlarṇagarūpato 'lpam</b> <b>vyaktasya pakṣasya padaṃ yadi syāt/</b> <b>ṛṇaṃ dhanam tac ca vidhāya sādhyam</b> <b>avyaktamānaṃ dvididham kvacit tat//61//<sup>249</sup></b></p>	<p>59</p> <p>60</p> <p>61</p>
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yatra pakṣayoḥ samaśodhane saty ekasmin pakṣe 'vyaktavargādikaṃ syād  
anyapakṣe rūpāny eva tatra dvāv api pakṣau kenacid ekeneṣṭena tathā guṇyau  
bhājyau vā tathā kiṃcit samaṃ kṣepyaṃ śodhyaṃ vā yathāvyaktapakṣo mūla-  
daḥ syāt/ tasmin pakṣe mūlada itarapakṣeṅārthān mūladena bhavitavyaṃ yataḥ  
samau pakṣau/ samayoḥ samayogādaḥ samataiveti/ atas tatpadayoḥ punaḥ samī-  
karaṇenāvyaktasya mānaṃ syāt//61p1//

atha yady evaṃ kṛte ghanavargavargādiṣu satsu kathamcid avyaktapakṣamūlā-  
bhāvāt kriyā na nirvahati tadā buddhyaivāvyaktamānaṃ jñeyam/ yato buddhir eva  
pāramārthikaṃ bījam//61p2//

atha yady avyaktapakṣamūle yāny ṛṇarūpāṇi tebhyo 'lpāni vyaktapakṣamūla-  
rūpāṇi syus tadā tāni dhanagatāny ṛṇagatāni kṛtvāvyaktamitiḥ sādhyā sā caivaṃ  
dvidhā bhavati kvacit//61p3//<sup>250</sup>

atra śrīdharācāryasūtram/Q3p0/

<sup>245</sup>athaikavarṇamadhyamāhararāṇam/ A ] ∅ MG.

<sup>246</sup>atra AM ] tatra G.

<sup>247</sup>pakṣo 'sya AMG ] pa o 'sya T, pado 'sya T(cor), pakṣasya P.

<sup>248</sup>mūlasya AMT ] pakṣasya GP; ced ghana AMG ] ceddhana TP.

<sup>249</sup>kvacit tat GP ] kvacitsyāt AM, kvacittu T.

<sup>250</sup>dhanagatāny ṛṇagatāni AM ] dhanagatāni G; bhavati kvacit AM ] bhavati G.

**‘caturāhatavargasamai rūpaiḥ pakṣadvayaṃ guṇayet/  
avyaktavargarūpair yuktau pakṣau tato mūlam’//Q3//<sup>251</sup>** Q3

//61p4//<sup>252</sup>

udāharaṇam/E61p0/

**alikuladalamūlam mālatīm yātam aṣṭau  
nikhilanavamabhāgās cālinī bhṛṅgam ekaṃ/** E61

<sup>251</sup>Cited from Śrīdhara’s lost work on bījagaṇita. samai AMGP(K) ] sama T(K) (T(K) reads samai in another quotation, p. 190, ll. 23–24); avyakta ... mūlam (2nd line of the verse) AM ] pūrvāvyaktasya kṛteḥ samarūpāṇi kṣipet tayor eva GT(K)P(K). Śrīdhara’s verse cited in AM, composed in Upagīti meter, refers to taking the square roots of both sides of the equation, while the same cited in GT(K)P(K), composed in Udgīti meter, does not. Sūryadāsa cites exactly the same verse as the one cited in AM in his commentary on E61. I cite here his comment on Śrīdhara’s verse from PPM(Wai) 9772/11-2/551, fol. 62b, l. 4 – fol. 63a, l. 5:

atha ‘avyaktavargādi yadāvaśeṣam’ (BG 59a) iti sūtrakramāt pakṣau kenacit saṃguṇya kiṃcit prakṣipya mūlam grāhyam iti prāpte kena guṇanīyaṃ kiṃ ca kṣepyam iti vyākulitacittānām mugdhachātrāṇām saṃśayāpanodārthaṃ śrīdharācāryaḥ svagaṇite sūtraṃ viracitavān/ tad yathā/ (Q3 is cited here)//

asyārthaḥ/ ‘pakṣadvaya’-śeṣam ‘caturāhatavargasamai rūpair’ ‘guṇayet’/ tataḥ pakṣau ‘avyaktavargarūpair yuktau’ kāryau/ ‘tato mūlam’ grāhyam ity arthaḥ//

pūrvasamaśodhanānantaram yad avyaktavargādy avaśeṣakam urvaritaṃ tatra pṛthag avyakta-  
vargāṅkaṃ caturguṇam vidhāya tatpramitavargarūpaiḥ pakṣadvayaṃ guṇayet/ tato ‘vyakta-  
vargāgre yaḥ kevalāvyakta āsīt tasya vargapramitāni rūpāṇi pakṣadvaye ‘pi yathāsthānaṃ yojayet/  
evaṃ kṛte sati pakṣadvaye ‘pi vargarāśayo bhavanti/ tatas tebhyaḥ sakāśān mūlam grāhyam/ evaṃ  
pakṣadvayamūlayoḥ parasparam samaśodhanena yāvattāvanmānaṃ labhyate//

nanv atra ‘caturāhatavargasamair’ ity anenaiva caritārthatvād ‘rūpa’-padam anarthakam iti cen  
na/ pakṣadvaye ‘pi mūlasaṃbhavāt/ yataś ‘caturāhatavargasamaiḥ’ pṛthag vyaktapakṣe guṇanīye  
tadvargavargahanādāyo ‘pi bhavyeṣu tathāpi ca mūlagrahaṇe kriyamāṇe kriyāvicchittih/ ato rūpa-  
padagrahaṇam//

atha śrīdharoktamūlaprakāre kriyājādyadarśanāt tatra mugdhān praty āyāso mā bhūd ity etad-  
artham asmābhiḥ svagaṇite pakṣadvayasya vargikaraṇavyatirekeṇāpi siddhamūlānayanaprakāro  
‘pihitah/ sa yathā/

**avyaktavargo dviguṇo vidheyaś cāvyakta evaṃ parikalpya rūpam/  
varṇāhato ‘nyo dviguṇas ca rūpavargānvitas tatpadam atra mūlam// iti//**

Read enaṃ for evaṃ in the 1st line of Sūryadāsa’s verse. For the algorithm given in the verse see under Q3 in Appendix 1.

<sup>252</sup>MG place 61p4 before 61p1.



**niśi parimalalubdham padmamadhye niruddham  
pratiraṇati raṇantaṃ brūhi kānte 'lisaṃkhyā//E61//<sup>253</sup>**

atrālikulapramāṇam yāva 2/ etadardhamūlam yā 1/ nikhilanavamabhāgā aṣṭau  
yāva  $\frac{16}{9}$  / mūlabhāgaikyam dṛṣṭāliyugalayutaṃ rāsīsamam iti pakṣau sama-  
chedikṛtya chedagame nyāsah/

yāva	18	yā	0	rū	0
yāva	16	yā	9	rū	18

śodhane kṛte jātau pakṣau

yāva	2	yā	9̇	rū	0
yāva	0	yā	0	rū	18

etāv aṣṭabhiḥ saṃguṇya tayor ekāśītirūpāni prakṣipyā mūle gṛhītvā tayoh samī-  
karaṇārtham nyāsah/

yā	4	rū	9̇
yā	0	rū	15

prāgval labdham yāvattāvanmānam 6/ asya vargeṇotthāpitā jātālikulasamkhyā  
72//E61p//<sup>254</sup>

udāharaṇam/E62p0/

**pārthaḥ karṇavadhāya mārgaṇagaṇam kruddho raṇe saṃdadhe** E62  
**tasyārdhena nivārya taccharagaṇam mūlaiś caturbhir hayān/**  
**śalyam ṣaḍbhir atheṣubhis tribhir api chatraṃ dhvajam karmukam**  
**cicchedāsyā śiraḥ śareṇa kati te yān arjunas saṃdadhe//E62//<sup>255</sup>**

atra bāṇasamkhyā yāva 1/ asyārdham yāva  $\frac{1}{2}$  / caturguṇitāni mūlāni yā 4/  
vyaktamārgaṇagaṇaḥ rū 10/ eṣām aikyam asya yāva 1 samam kṛtvā labdhayāvāt-  
tāvanmānena 10 utthāpitā jātā bāṇasamkhyā 100//E62p//<sup>256</sup>

udāharaṇam/E63p0/

**vyekasya gacchasya dalaṃ kilādir** E63  
**āder dalaṃ tatpracayaḥ phalaṃ ca/**  
**cayādigacchābhihatih svasapta-**  
**bhāgādhikā brūhi cayādigacchān//E63//**

<sup>253</sup> alikuladalamūlam mālatim yātam aṣṭau nikhilanavamabhāgās AMGTP(L)(ASS) ] alikuladalam-  
abdhestirayātam tathāṣṭau dalitanavamabhāgās L(VIS); parimalalubdham AMGTP(L)(ASS) ] pada-  
dalahīnam L(VIS); niruddham AMGPL ] nibaddham T.

<sup>254</sup> yā 1 AM ] yāva 1 G; aṣṭabhiḥ AM ] aṣṭābhiḥ G; samīkaraṇārtham AM ] sāmīkaraṇārtham G;  
prāgval G ] prāgval AM.

<sup>255</sup> yān AMGTP(L)(VIS) ] yām L(ASS); saṃdadhe (2nd) MGTP(L) ] saṃdagdhe A.

<sup>256</sup> caturguṇitāni AM ] ∅ G.

atra gacchaḥ yā 4 rū 1/ ādih yā 2/ pracayaḥ yā 1/ eṣāṃ ghātaḥ svasapta-  
bhāgādhikaḥ yāgha  $\frac{64}{7}$  yāva  $\frac{16}{7}$  / phalam idam ‘vyekapadaghnacaya’ (L 121)  
iti śreḍhīgaṇitasyāsya yāgha 8 yāva 10 yā 2 samam iti pakṣau yāvattāvātāpavartya  
samacchedikṛtya chedagame śodhane ca kṛte jātau pakṣau

$$\begin{array}{|c|c|c|c|c|c|} \hline yāva & 8 & yā & 54 & rū & 0 \\ \hline yāva & 0 & yā & 0 & rū & 14 \\ \hline \end{array}$$

etayor aṣṭagaṇayoḥ saptaviṃśativarga 729 yutayor mūle

$$\begin{array}{|c|c|c|c|} \hline yā & 8 & rū & 27 \\ \hline yā & 0 & rū & 29 \\ \hline \end{array}$$

punar anayoḥ samīkaraṇenāptayāvattāvanmānena 7 utthāpitā ādyuttaragacchāḥ  
14/ 7/ 29//E63p//<sup>257</sup>

udāharaṇam/E64p0/

**kaḥ khena vihr̥to rāsīr ādyayukto navonitaḥ/  
vargitaḥ svapadenādhyaḥ khagaṇo navatir bhavet//E64//<sup>258</sup>**

E64

<sup>257</sup>54 AM ] 54 G; punar anayoḥ MG ] punarayo A.

<sup>258</sup>rāsīr ādyayukto navonitaḥ AM (see E64p1) ] rāsīḥ koṭyā yukto ’thavonitaḥ GP (see E64p3),  
rāsīḥrādyāyukto thavonitaḥ T (see E64p2). E64p2 treats the same equation as accepted by T as a  
variant reading (pāṭha) but it would be strange if the author himself refers to a ‘variant reading’  
of his own verse. It is also curious that Kṛṣṇa in T comments on the form accepted by T and in P  
the form accepted by P. See also the next footnote. Sūryadāsa solves the same equation as treated  
in E64p1 (reading ‘bhājitaḥ’ for ‘vihr̥taḥ’) but here also we come across a curious situation: he  
takes the word ‘ādya’ (E64b) in the sense of ‘the first one’ in his solution but in the sense of ‘the  
preceding one’ in his verification (ālāpa-yojanā) if ‘asyādyaḥ 8’ is not a scribal error for ‘asyādyaḥ  
9’. I cite here his comment on E64 from PPM(Wai) 9772/11-2/551, fol. 64a, l. 11 – fol. 64b, l. 10:

atha prākkathitaśūnyaṣaḍvidhakartavyatāpradarśanārtham udāharaṇam āha/ ‘kaḥ khena  
bhājita’ (E64a) iti/ spaṣṭam//

evam atrājñātarāśer mānam yā 1/ ayaṃ khena bhājitaḥ  $\frac{1}{0}$  / atra khaharatvaṃ kalpitam eva/  
tato ’yam ādyenānena yā 1 yuto jātaḥ (yā) 2/ ayaṃ navonitaḥ yā 2 rū  $\frac{9}{81}$  / vargitaś ca yāva 4 yā  $\frac{36}{81}$   
rū 81/ ayaṃ svapadenānena yā 2 rū  $\frac{9}{81}$  yathāsthānaṃ yuto jātaḥ yāva 4 yā  $\frac{34}{81}$  rū 72/ ayaṃ śūnya-  
gaṇitaḥ san navatisamo bhavatīti śūnyena gaṇane prāpta ācāryaḥ pāṭigaṇite viśeṣam uktavān/ (L  
46abc = Q5abc (see E65p2) with ‘jñeyaḥ’ for ‘vicintyaḥ’ is cited here) iti/ evaṃ ‘kaḥ khena bhājito  
rāsīr’ (E64a) ity atra pūrvaṃ śūny(o) hāra āsīt/ idānīm śūnya eva gaṇaka utpannaḥ/ ata ubhayos  
tulyatvān nāśe kṛte rāsīr avikṛta eva sthitaḥ/ tathākṛto ’yam navatisama iti samaśodhanāya nyāsaḥ/

$$\begin{array}{|c|c|c|c|c|c|} \hline yāva & 4 & yā & 34 & rū & 72 \\ \hline yāva & 0 & yā & 0 & rū & 90 \\ \hline \end{array}$$

samaśodhanād idam eva pakṣaśeṣam

<sup>259</sup>atra rāśiḥ yā 1/ ayam khahṛtaḥ yā  $\frac{1}{0}$  / asya khaharatvaṃ kalpitam eva/ ādyena yā 1 yukto jātaḥ yā 2/ navonitaḥ yā 2 rū  $\overset{\bullet}{9}$ / vargitaḥ yāva 4 yā  $\overset{\bullet}{36}$  rū 81/ svapadena yā 2 rū  $\overset{\bullet}{9}$  yutaḥ yāva 4 yā  $\overset{\bullet}{34}$  rū 72/ ayam śūnyaguṇo navatisama iti śūnyena guṇane prāpte ‘śūnye guṇake jāte khaṃ hāraś cet’ (L 46ab) iti pūrvaśūnyo hara idānīm guṇas tasmād ubhayor guṇaharayor nāśaḥ/ evaṃ pakṣau

$$\begin{array}{|c|c|c|c|c|} \hline yāva & 4 & yā & \overset{\bullet}{34} & rū & 72 \\ \hline yāva & 0 & yā & 0 & rū & 90 \\ \hline \end{array}$$

samaśodhanāt pakṣaśeṣe

$$\begin{array}{|c|c|c|c|c|} \hline yāva & 4 & yā & \overset{\bullet}{34} & rū & 0 \\ \hline yāva & 0 & yā & 0 & rū & 18 \\ \hline \end{array}$$

etau pakṣau ṣoḍaśabhiḥ saṃguṇya catustriṃśadvargatulyāni rūpāṇi prakṣipya mūle gṛhītvā pakṣayoḥ śodhanārtham nyāsaḥ/

$$\begin{array}{|c|c|c|c|} \hline yā & 8 & rū & \overset{\bullet}{34} \\ \hline yā & 0 & rū & 38 \\ \hline \end{array}$$

uktavaj jāto rāśiḥ 9//E64p1//<sup>260</sup>

atra vādyayukto 'thavonita iti pāṭhe rāśiḥ yā 1/ khahṛtaḥ  $\frac{yā}{0} 1$  / ādyena yā 1 yuktonīkaraṇāya khaharatvāt samacchedīkaraṇena śūnyenaiva yuktonitaḥ sa eva  $\frac{yā}{0} 1$  / vargitaḥ  $\frac{yāva}{0} 1$  / svapadenādhyah  $\frac{yāva}{0} 1$  yā 1 / ayam khaguṇaḥ/ pūrvaṃ khaharatvād guṇaharayor nāśe kṛte jātaḥ yāva 1 yā 1/ ayam navatisama iti samaśodhanārtham nyāsaḥ/

$$\begin{array}{|c|c|c|c|c|} \hline yāva & 1 & yā & 1 & rū & 0 \\ \hline yāva & 0 & yā & 0 & rū & 90 \\ \hline \end{array}$$

$$\begin{array}{|c|c|c|c|} \hline yāva & 4 & yā & \overset{\bullet}{34} \\ \hline rū & 18 & & \\ \hline \end{array}$$

atroktavad utpannayoh pakṣamūlayoh samaśodhanāya nyāsaḥ

$$\begin{array}{|c|c|c|c|} \hline yā & 8 & rū & \overset{\bullet}{34} \\ \hline yā & 0 & rū & 38 \\ \hline \end{array}$$

atrāptaṃ yāvattāvanmānam 9/ ayam eva rāśir iti siddham//

atrālāpayojanā/ tatra rāśiḥ 9/ ayam khena bhājitaḥ san jātaḥ khaharaḥ  $\frac{9}{0}$  / asyādyah 8/ anena samacchidā yuto jātaḥ  $\frac{9}{0}$  / yataḥ ‘asmin vikāraḥ khahare na rāśāv’ (BG 6a) iti pūrvaṃ evoktam/ athāyam  $\frac{9}{0}$  navonitaḥ san khaharatvāt punas tathaiva jātam  $\frac{9}{0}$  / asau vargitaḥ  $\frac{81}{0}$  / svapadenānena  $\frac{9}{0}$  yuto jātaḥ  $\frac{90}{0}$  / punaḥ khaguṇaḥ san jātā navatiḥ 90//

<sup>259</sup>AM have E64p1 and E64p2 but not E64p3; G places E64p3 before E64p1 and its editor cites E64p2 from a certain ‘printed book’ (mudrita-pustaka).

<sup>260</sup>rū  $\overset{\bullet}{9}$  (1st) AM ] rū 9 G; rū  $\overset{\bullet}{9}$  (2nd) G ] rū 9 AM;  $\begin{array}{|c|c|c|c|} \hline yā & 8 & rū & \overset{\bullet}{34} \\ \hline yā & 0 & rū & 38 \\ \hline \end{array}$  A ] yā 8 rū  $\overset{\bullet}{34}$  = yā 0 rū

38/ M,  $\begin{array}{|c|c|c|c|} \hline yā & 8 & rū & 34 \\ \hline yā & 0 & rū & 38 \\ \hline \end{array}$  G.

samaśodhane kṛte pakṣāv imau caturbhiḥ saṃguṇyaikaṃ kṣiptvā mūle

$$\begin{array}{|c|c|c|c|} \hline yā & 2 & rū & 1 \\ \hline yā & 0 & rū & 19 \\ \hline \end{array}$$

atra samaśodhanāj jātāḥ prāgvad rāśiḥ 9//E64p2//<sup>261</sup>

atra rāśiḥ yā 1/ ayam khahṛtaḥ yā  $\frac{1}{0}$  / ayam koṭyā yukta ūnito vāvikṛta eva khaharatvāt/ athāyaṃ yā  $\frac{1}{0}$  vargitaḥ yāva  $\frac{1}{0}$  svapadena yā  $\frac{1}{0}$  yuktaḥ yāva  $\frac{1}{0}$  yā  $\frac{1}{0}$  / ayam khagūṇo jātāḥ yāva 1 yā 1 guṇaharayos tulyatvena nāśāt/ athāyaṃ navatisama iti samaśodhane pakṣau caturbhiḥ saṃguṇya rūpaṃ prakṣipya prāgvaj jāto rāśiḥ 9//E64p3//<sup>262</sup>

udāharaṇam/E65p0/

**kaḥ svārdhasahito rāśiḥ khagūṇo vargito yutaḥ/**

E65

**svapadābhyāṃ khabhaktāś ca jātāḥ pañcadaśocyatām//E65//<sup>263</sup>**

atra rāśiḥ yā 1/ ayam svārdhayutaḥ yā  $\frac{3}{2}$  / 'khagūṇaḥ khaṃ' (Q4c = L45c) na kāryaḥ kimtu 'khagūṇa' eva 'cintyaḥ' 'śeṣavidhau' (Q4d = L45d) kartavye yā  $\frac{3}{2}$  / vargitaḥ yāva  $\frac{9}{4}$  / svapadābhyāṃ yā 3 yuto jātāḥ yāva  $\frac{9}{4}$  yā 12 / ayam khabhaktāḥ/ atrāpi prāgvad guṇaharayos tulyatvān nāśe kṛte 'vikṛto rāśiḥ/ taṃ ca pañcadaśasamaṃ kṛtvā samacchedikṛtya chedagame śodhanāj jātau pakṣau

$$\begin{array}{|c|c|c|c|c|} \hline yāva & 9 & yā & 12 & rū & 0 \\ \hline yāva & 0 & yā & 0 & rū & 60 \\ \hline \end{array}$$

etau caturyutau kṛtvā mūle gṛhītvā punaḥ samaśodhanāl labdhaṃ yāvattāvanmānam 2//E65p1//<sup>264</sup>

tathā cāsmatpātīganite/Q4p0/

**‘yoge khaṃ kṣepasamaṃ**

**vargādaḥ khaṃ khabhājito rāśiḥ/’**

**khaharaḥ syāt khagūṇaḥ khaṃ**

Q4

**khagūṇaś cintyaś ca śeṣavidhau’//Q4//**

**‘śūnye guṇake jāte khaṃ hāraś cet punas tadā rāśiḥ/**

Q5

**avikṛta eva vicintyaḥ sarvatraivaṃ vipaścidbhiḥ’//Q5//<sup>265</sup>**

<sup>261</sup>atra vādyayukto AM ] athavādyayukto G; pāṭhe AM ] pāṭhe tu G;  $yā \frac{1}{0}$  (twice) AM ] yā  $\frac{1}{0}$  G;  $yāva \frac{1}{0}$  AM ] yāva  $\frac{1}{0}$  G;  $yāva \frac{1}{0} yā \frac{1}{0}$  AM ] yāva  $\frac{1}{0} yā \frac{1}{0}$  G; samaśodhanārthaṃ AM ] samaśodhanāya G.

<sup>262</sup>vāvikṛta ] vāvikṛt G; yāva  $\frac{1}{0} yā \frac{1}{0}$  ] yāva 1 yā 1 G.

<sup>263</sup>jātāḥ AMG ] jātāḥ TP.

<sup>264</sup>yutaḥ AM ] yuktaḥ G; khagūṇa eva cintyaḥ AM ] khagūṇaścintyaḥ G; yā 3 AM ] yā  $\frac{6}{2}$  G; taṃ ca G ] tacca AM.

<sup>265</sup>Cited from L 45–46. vicintyaḥ sarvatraivaṃ vipaścidbhiḥ AM ] jñeyaḥ sarvatraivaṃ vipaścidbhiḥ G, jñeyas tathaiva khenonitaś ca yutaḥ L.

//E65p2//

udāharaṇam/E66p0/

**rāśir dvādaśanighno rāśighanāḍhyaś ca kaḥ samā yasya/  
rāśikṛtiḥ ṣaḍguṇitā pañcatrimśadyutā vidvan//E66//<sup>266</sup>**

E66

atra rāśiḥ yā 1/ ayaṃ dvādaśaguṇito rāśighanāḍhyaś ca yāgha 1 yā 12/ ayaṃ  
yāva 6 rū 35 anena sama iti śodhane kṛte jātam ādyapakṣe yāgha 1 yāva 6 yā 12/  
anayapakṣe rū 35/ anayor ṛṇarūpāṣṭakam prakṣipyā ghanamūle

$$\begin{array}{|c|c|c|c|} \hline yā & 1 & rū & \overset{\bullet}{2} \\ \hline yā & 0 & rū & 3 \\ \hline \end{array}$$

punar anayoḥ samīkaraṇena jāto rāśiḥ 5//E66p//<sup>267</sup>

udāharaṇam/E67p0/

**ko rāśir dviśatikṣuṇṇo rāśivargayuto hataḥ/  
dvābhyāṃ tenonito rāśivargavargo 'yutaṃ bhavet/  
rūponaṃ vada taṃ rāśim vetsy bijakriyāṃ yadi//E67//**

E67

atra rāśiḥ yā 1/ dviśatikṣuṇṇaḥ yā 200/ rāśivargayuto jātaḥ yāva 1 yā 200/ ayaṃ  
dvābhyāṃ guṇitaḥ yāva 2 yā 400/ anenāyaṃ rāśivargavarga ūnito jātaḥ yāvava 1  
yāva 2 yā 400/ ayaṃ rūponāyutasama iti samaśodhane kṛte jātau pakṣau/

$$\begin{array}{|c|c|c|c|c|c|c|} \hline yāvava & 1 & yāva & \overset{\bullet}{2} & yā & \overset{\bullet}{400} & rū & 0 \\ \hline yāvava & 0 & yāva & 0 & yā & 0 & rū & 9999 \\ \hline \end{array}$$

atrādyapakṣe kila yāvattāvaccatuḥśatīm rūpādhikāṃ prakṣipyā mūlaṃ labhyate/  
paraṃ tāvati kṣipte nānyapakṣasya mūlam asti/ evaṃ kriyā na nirvahati/ ato 'tra  
svabuddhiḥ/ iha pakṣayor yāvattāvadvargacatuṣṭayaṃ yāvattāvaccatuḥśatīm rūpaṃ  
ca prakṣipyā mūle

$$\begin{array}{|c|c|c|c|c|c|} \hline yāvava & 1 & yā & 0 & rū & 1 \\ \hline yāvava & 0 & yā & 2 & rū & 100 \\ \hline \end{array}$$

punar anayoḥ samīkaraṇena prāgval labdhaṃ yāvattāvanmānam 11/ ityādi buddhi-  
matā jñeyam//E67p//<sup>268</sup>

udāharaṇam/E68p0/

**vanāntarāle plavagāṣṭabhāgaḥ  
saṃvargito valgati jātarāgaḥ/**

E68

<sup>266</sup>samā yasya GT ] samo yaḥ syāt AM, samo yasya P.

<sup>267</sup>yāgha 1 (2nd) AG ] yāgha 1 M; anayor ṛṇa MG ] anayo ṛṇa A.

<sup>268</sup>rāśivargavarga G ] yāvava 1 rāśivargavarga AM;  $\begin{array}{|c|c|c|c|c|} \hline yāvava & 1 & yā & 0 & rū & 1 \\ \hline yāvava & 0 & yā & 2 & rū & 100 \\ \hline \end{array}$  AM ]

yāvava 1 rū 1  
yā 2 rū 100 G.

**phūtkāranādapratinādahr̥ṣṭā**

**dr̥ṣṭā girau dvādaśa te kiyantaḥ**//E68//<sup>269</sup>

atra kapiyūtham yā 1/ asyāṣṭāṁśavargo dvādaśayuto yūthasama iti pakṣau

$$\begin{array}{|c|c|c|c|c|} \hline yāva & 1 & yā & 0 & rū & 768 \\ \hline yāva & 0 & yā & 1 & rū & 0 \\ \hline \end{array}$$

etau samacchedikṛtya chedagame śodhane ca kṛte jātau pakṣau

$$\begin{array}{|c|c|c|c|c|} \hline yāva & 1 & yā & 64 & rū & 0 \\ \hline yāva & 0 & yā & 0 & rū & 768 \\ \hline \end{array}$$

iha pakṣayor dvātriṁśadvargaṁ 1024 prakṣipya mūle

$$\begin{array}{|c|c|c|c|} \hline yā & 1 & rū & 32 \\ \hline yā & 0 & rū & 16 \\ \hline \end{array}$$

atrāvyaktapakṣarṇarūpebhyo 'lpāni vyaktapakṣarūpāni santi/ tāni dhanam ṛṇam ca kṛtvā labdham dvididham yāvattāvanmānam 48/ 16//E68p//<sup>270</sup>

udāharaṇam/E69p0/

**yūthāt pañcāṁśakas tryūno vargito gahvaram gataḥ**

E69

**dr̥ṣṭaḥ śākhāmṛgaḥ śākhām ārūḍho vada te kati**//E69//<sup>271</sup>

atra yūthapramāṇam yā 1/ atra pañcāṁśakas tryūnaḥ  $\begin{array}{|c|c|c|} \hline yā & 1 & rū & 15 \\ \hline & & & 5 \\ \hline \end{array}$  vargi-

taḥ  $\begin{array}{|c|c|c|c|} \hline yāva & 1 & yā & 30 & rū & 225 \\ \hline & & & 25 & & \\ \hline \end{array}$  etaddr̥ṣṭena yutaḥ  $\begin{array}{|c|c|c|c|} \hline yāva & 1 & yā & 30 & rū & 250 \\ \hline & & & 25 & & \\ \hline \end{array}$  yū-

thasama iti pakṣau samacchedikṛtya chedagame śodhane ca kṛte jātau

$$\begin{array}{|c|c|c|c|c|} \hline yāva & 1 & yā & 55 & rū & 0 \\ \hline yāva & 0 & yā & 0 & rū & 250 \\ \hline \end{array}$$

etau caturbhiḥ saṁguṇya pañcāpañcāśadvargaṁ 3025 prakṣipya mūle

$$\begin{array}{|c|c|c|c|} \hline yā & 2 & rū & 55 \\ \hline yā & 0 & rū & 45 \\ \hline \end{array}$$

<sup>269</sup>plavagāṣṭa MGTP ] plapagāṣṭa A; phūt AM ] brūt GTP.

<sup>270</sup>yā 1 AM ] yāvattāvat 1 G;  $\begin{array}{|c|c|c|c|c|} \hline yāva & 1 & yā & 0 & rū & 768 \\ \hline yāva & 0 & yā & 1 & rū & 0 \\ \hline \end{array}$  AM ]

yāva  $\frac{1}{64}$  yā 0 rū 768 G; etau AM ] anayoḥ G; śodhane MG ] sodhane A; yāva 0 yā 1 rū 0 pakṣayor MG ] ṣakṣayor A; 1024 AM ] 0 G; santi MG ] sagti A.

<sup>271</sup>śākhām AMGP ] śāravām T.

atrāpi prāgval labdham dvididham mānam 50/ 5/ dvitīyam atra na grāhyam anu-  
papannatvāt/ na hi vyakta ṛṅgate lokasya pratītir astīti//E69p//<sup>272</sup>  
udāharaṇam/E70p0/

**karnasya trilavenonā dvādaśāṅgulaśaṅkubhā/  
caturdaśāṅgulā jātā gaṇaka brūhi tāṃ drutam//E70//**

E70

atra chāyā yā 1/ iyaṃ karṇatryaṃsonā caturdaśāṅgulā jātā/ ato vaiparītyenāsyāś  
caturdaśa viśodhya śeṣaṃ karṇatryaṃśaḥ yā 1 rū 14/ ayaṃ triguṇo jātaḥ karṇaḥ yā  
3 rū 42/ asya vargaḥ yāva 9 yā 252 rū 1764 karṇavargenānena yāva 1 rū 144 sama  
iti samaśodhane kṛte jātau pakṣau

$$\begin{array}{|c|c|c|c|c|c|} \hline yāva & 8 & yā & 252 & rū & 0 \\ \hline yāva & 0 & yā & 0 & rū & 1620 \\ \hline \end{array}$$

etau pakṣau dvābhyāṃ saṃguṇyarnatṛiṣaṣṭivargaṃ prakṣipya mūle

$$\begin{array}{|c|c|c|c|} \hline yā & 4 & rū & 63 \\ \hline yā & 0 & rū & 27 \\ \hline \end{array}$$

pakṣayoḥ punaḥ samīkaraṇaṃ kṛtvā prāgval labdham dvididham yāvattāvanmānam  
 $\frac{45}{2}$  / 9/ utthāpīte chāye ca  $\frac{45}{2}$  / 9/ dvitīyacchāyā caturdaśabhyo nyūnā/ ato 'nu-  
papannatvān na grāhyā/ ata uktaṃ 'dvididham kvacid' (BG 61d) iti//E70p1//<sup>273</sup>  
atra padmanābhabīje/Q6p0/

**'vyaktapakṣasya cen mūlam anyapakṣarṇarūpataḥ/  
alpaṃ dhanarṇagaṃ kṛtvā dvididhotpadyate mitiḥ'//Q6//<sup>274</sup>**

Q6

iti yat paribhāṣitaṃ tasya vyabhicāro 'yam//E70p2//  
udāharaṇam/E71p0/

**catvāro rāśayaḥ ke te mūladā ye dviṣaṃyutāḥ/  
dvayor dvayor yathāsannaghātāś cāṣṭādaśānvitāḥ//E71//  
mūladāḥ sarvamūlaikyād ekādaśayutāt padam/**

E71

E72

<sup>272</sup>yā 1 (1st) AM ] yāvattāvat 1 G;  $\begin{array}{|c|c|c|} \hline yā & 1 & rū & 15 \\ \hline & 5 & & \end{array}$  AM ] yā  $\frac{1}{5}$  rū  $\frac{15}{5}$  G;  
 $\begin{array}{|c|c|c|c|} \hline yāva & 1 & yā & 30 \\ & 25 & & 225 \\ \hline \end{array}$  AM ] yāva  $\frac{1}{25}$  yā  $\frac{30}{25}$  rū  $\frac{225}{25}$  G;  $\begin{array}{|c|c|c|c|} \hline yāva & 1 & yā & 30 \\ & 25 & & 250 \\ \hline \end{array}$  AM ]  
yāva  $\frac{1}{25}$  yā  $\frac{30}{25}$  rū  $\frac{250}{25}$  G; pakṣau AM ] ∅ G; etau AM ] ∅ G; mānam AM ] yāvattāvanmānam  
G.

<sup>273</sup>caturdaśa G ] caturdaśaṃ AM.

<sup>274</sup>Cited from Padmanābha's lost work on bījagaṇita. Kṛṣṇa does not refer to this meta-rule of  
Padmanābha, while Sūryadāsa does. According to him, Q6d reads: 'dvidhā mānaṃ kvacid bhavet'

trayodaśa sakhe jātaṃ bījajña vada tān mama//E72//<sup>275</sup>

atra rāśir yena yuto mūlado bhavati sa kila rāśikṣepaḥ/ mūlayor antaravargeṇa  
hato rāśikṣepo vadhakṣepo bhavati/ tayo rāśyor vadhas tena yuto 'vaśyaṃ mūladaḥ  
syād ity arthaḥ/ rāśimūlānāṃ yathāsannaṃ dvayor dvayor vadhā rāśikṣepoṇā rāśi-  
vadhāmūlāni bhavanti//E72p1//<sup>276</sup>

atrodāharaṇe rāśikṣepād vadhakṣepo navagaṇaḥ/ navānāṃ mūlaṃ trayāḥ/ atas  
tryuttarāṇi rāśimūlāni/

yā	1	rū	0
yā	1	rū	3
yā	1	rū	6
yā	1	rū	9

eṣāṃ dvayor dvayor vadhā rāśikṣepoṇāḥ santaḥ rāśivadhānāṃ aṣṭādaśayutānāṃ  
mūlāni bhavanti/ ata uktavad vadhamūlāni/

yāva	1	yā	3	rū	2
yāva	1	yā	9	rū	16
yāva	1	yā	15	rū	52

eṣāṃ pūrvamūlānāṃ ca sarveṣāṃ yogāḥ yāva 3 yā 31 rū 84/ idam ekādaśayutaṃ  
trayodaśavargasamaṃ kṛtvā

yāva	3	yā	31	rū	95
yāva	0	yā	0	rū	169

pakṣaśeṣe dvādaśabhiḥ saṃguṇya tayor ekatrimśadvargaṃ 961 nikṣipya mūle/

yā	6	rū	31
yā	0	rū	43

punar anayoḥ samīkaraṇāl labdhena yāvattāvanmānena 2 anenotthāpitāni rāśi-  
mūlāni 2/ 5/ 8/ 11/ eṣāṃ vargā rāśikṣepoṇā arthād rāśayo bhavanti 2/ 23/ 62/  
119//E72p2//<sup>277</sup>

atrādyaparibhāṣā/Q7p0/

**‘rāśikṣepād vadhakṣepo yadgaṇas tatpadottaram/  
avyaktā rāśayaḥ kalpyā vargitāḥ kṣepavarjitāḥ’//Q7//<sup>278</sup>**

Q7

(PPM(Wai) 9772/11-2/551, fol. 68a, ll. 1-2).

<sup>275</sup>sakhe AMGP ] sarave T.

<sup>276</sup>hato AM ] hṛto G.

<sup>277</sup>(1st table) AG ] yā 1 rū 0/ yā 1 rū 3/ yā 1 rū 6/ yā 1 rū 9/ M; trayodaśavargasamaṃ kṛtvā (3rd  
table) G ] trayodaśavarga (3rd table) samaṃ kṛtvā AM; pakṣaśeṣe ] pakṣaśeṣāṃ AMG; samīkaraṇāl  
labdhena yāvattāvanmānena AM ] samīkaraṇena labdhayāvattāvanmānena G; rāśikṣepoṇā G ]  
rāśayaḥ kṣepinā AM.

<sup>278</sup>Source unidentified. avyaktā MG ] adhyaktā A, avyakta TP; varjitāḥ MGTP ] vajitāḥ A.

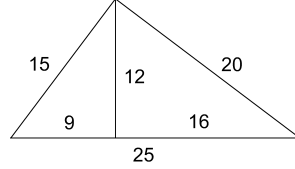


iyam kalpanā gaṇite 'tiparicitasya//E72p3//<sup>279</sup>  
udāharaṇam/E73p0/

**kṣetre tithinakhais tulye doḥkoṭī tatra kā śrutih/  
upapattiś ca rūḍhasya gaṇitasyāsyā kathyatām//E73//<sup>280</sup>**

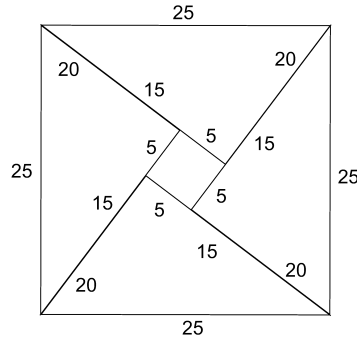
E73

atra karṇaḥ yā 1/ etattryasraṃ parivartya yāvattāvatarṇo bhūḥ kalpitā/ bhujakoṭī tu bhujau/ tatra yo lambas tadubhayato ye tryasre tayor api bhujakoṭī pūrvārūpe bhavataḥ/ atas trairāśikam/ yadi yāvattāvati karṇe 'yam 15 bhujas tadā bhujatulye karṇe ka iti labdho bhujah syāt/ sā bhujāśritāvādhā  $\frac{225}{yā 1}$  / punar yadi yāvattāvati karṇa iyam 20 koṭis tadā koṭitulye karṇe keti jātā koṭyāśritāvādhā  $\frac{400}{yā 1}$  / āvādhāyutir yāvattāvatarṇasamā kriyate/ tāvad bhujakoṭivargayogasya padaṃ karṇamānam upapadyate 25/ anenotthāpīte jāte āvādhē 9/ 16/ ato lambaḥ 12/ kṣetradarśanam/



//E73p1//<sup>281</sup>

athānyathā vā kathyate/ karṇaḥ yā 1/ doḥkoṭighātārdham tryasrakṣetrasya phalam 150/ etadviśamatryasracatuṣṭayena karṇasamacaturbhujam kṣetram anyat karṇajñānārtham kalpitam/



<sup>279</sup>'tiparicitasya G ] 'tiparicitā syāt AM.

<sup>280</sup>nakhais AMGP ] naravais T; śrutih MGTP ] śruti A.

<sup>281</sup>karṇo AM ] karṇe G; labdho AM ] labdham G; koṭitulye AM ] koṭi-20-tulye G; upapadyate 25 ] upapadyate AM, utpadyate 25 G; kṣetradarśanam AM ] nyāsaḥ G.

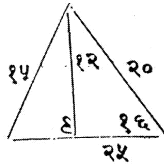


Fig. BGE73p-1a:

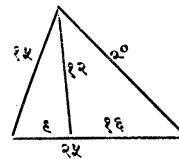


Fig. BGE73p-1g:

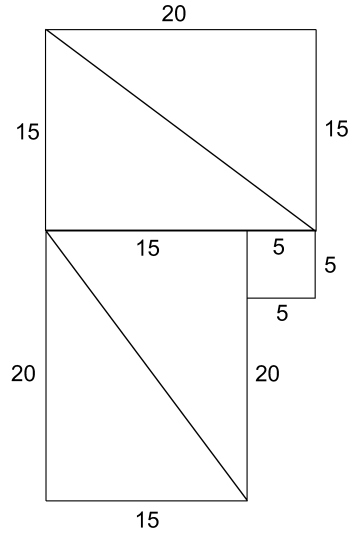
evaṃ madhye caturbhujam utpannam/ atra koṭibhujāntarasamaṃ bhujamānam  
5/ asya phalam 25/ bhujakoṭivadhō dviguṇas tryasrāṇāṃ caturṇāṃ phalam  
600/ etadyogaḥ sarvaṃ bṛhatkṣetraphalam 625/ etad yāvattāvadvargasamaṃ  
kṛtvā labdham karṇamānam 25/ yatra vyaktasya na padaṃ tatra karaṇīgataḥ  
karṇaḥ//E73p2//<sup>282</sup>

etatkaraṇasūtram vṛttam/62p0/

**doḥkoṭyantara vargeṇa dvighno ghātaḥ samanvitaḥ/  
vargayogasamaḥ sa syād dvayor avyaktayor yathā//62//<sup>283</sup>**

62

ato lāghavārtham doḥkoṭivargayogasya padaṃ karṇa ity upapannam/ tatra tāny  
api kṣetrasya khaṇḍāny anyathā vinyasya darśanam/

//62p//<sup>284</sup>

udāharaṇam/E74p0/

<sup>282</sup>karṇasamacaturbhujam ] karṇasamaṃ caturbhujam AMG; kalpitam AM ] kalpitam nyāsaḥ G;  
several numerals in the figure are missing in G; caturṇāṃ phalam 600/ etadyogaḥ sarvaṃ AM ]  
caturṇāmetadyogaḥ 600 sarvaṃ G; bṛhat MG ] vṛhat A; yāvattāvadvargasamaṃ AM ] yāvattāvāt-  
samaṃ G; karṇaḥ MG ] karṇaḥ 5 A.

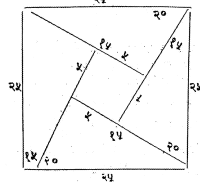


Fig. BGE73p-2a:

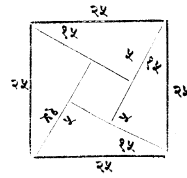


Fig. BGE73p-2g:

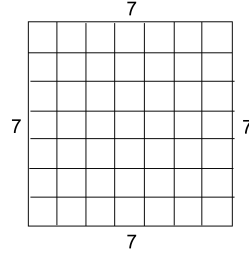
<sup>283</sup>koṭyantara AMGP ] koṭyantara T; yogasamaḥ AMGP ] yogassamaḥ T.

<sup>284</sup>yogasya padaṃ AM ] yogapadaṃ G; several numerals in the figure are missing in G.

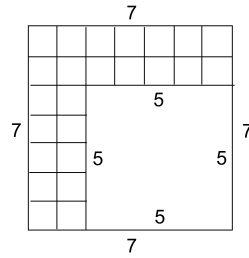
bhujāt tryūnāt padaṃ vyekaṃ koṭikarṇāntaraṃ sakhe/  
yatra tatra vada kṣetre doḥkoṭīśravaṇān mama//E74//

E74

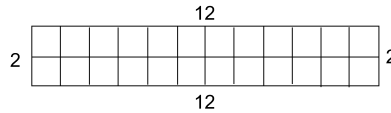
atra koṭikarṇāntaraṃ iṣṭam 2/ ato vilomena bhujāḥ 12/ tad yathā/ kalpitam  
iṣṭam 2/ asya sarūpasya 3 vargaḥ 9/ triyutaḥ 12/ asya vargaḥ 144/ tat koṭikarṇa-  
vargāntaraṃ/ ato rāśyor vargāntaraṃ yogāntaraghātasamaṃ syāt/ vargo hi sama-  
caturasrakṣetraphalam/ ayaṃ kila saptavargaḥ 49/



asmāt pañcavargaṃ 25 viśodhya śeṣasya 24 darśanam/



ihāntaraṃ dvau 2/ yogo dvādaśa 12/ yogāntaraghātasama 24 koṣṭhakāni var-  
tante/ taddarśanam/



ity upapannaṃ vargāntaraṃ yogāntaraghātasamaṃ iti/ ata idaṃ vargāntaraṃ  
144 kalpitakoṭikarṇāntareṇa 2 bhaktaṃ jātam 72/ ayaṃ 'yogo' dvidhā 'antareṇona-  
yuto 'rdhitaḥ' (L 56) iti saṃkramaṇena jātau koṭikarṇau 35/ 37/ evam ekena bhujā-  
koṭikarṇāḥ 7/ 24/ 25/ tribhiḥ 19/  $\frac{176}{3}$  /  $\frac{185}{3}$  / caturbhir vā 28/ 96/ 100/ evam

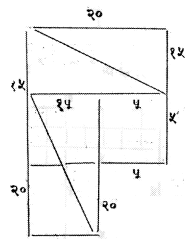


Fig. BG62p-1a:

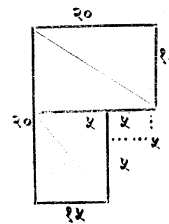


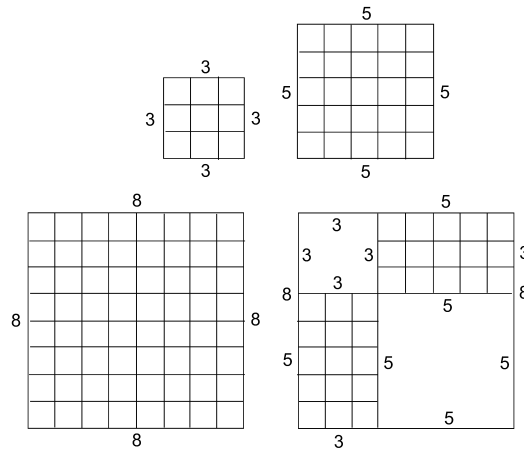
Fig. BG62p-1g:

anekadhā/ evaṃ sarvatra//E74p//<sup>285</sup>  
asya sūtram vṛttam/63p0/

vargayogasya yad rāśyor yutivargasya cāntaram/  
dvighnaghātasamānaṃ syād dvayor avyaktayor yathā//63//

63

atra rāśī 3/ 5/ anayor yutivargaḥ 64/ tayor vargau 9/ 25/ anayor yogaḥ 34/  
etayoḥ 64/ 34/ antaram 30/ idaṃ rāśyor ghātena 15 dvighnena 30 samaṃ bhavatīty  
upapannam/ teṣāṃ svarūpāṇi yathā/

//63p//<sup>286</sup>

<sup>285</sup>49 AM ] ∅ G; sama 24 koṣṭhakāni vartante AM(vartante) ] samakoṣṭhakā vartante 24 G;  
caturbhir vā MG ] catubhīrvā A; sarvatra AM ] sarvatra 3 G.

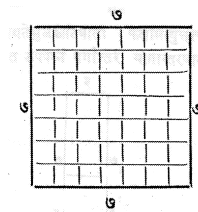


Fig. BGE74p-1a:

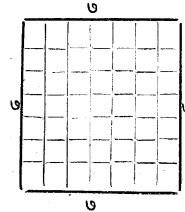


Fig. BGE74p-1g:

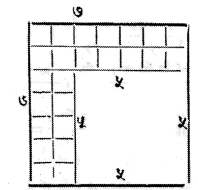


Fig. BGE74p-2a:

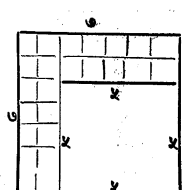


Fig. BGE74p-2g:

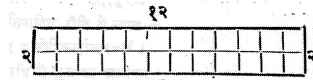


Fig. BGE74p-3a:

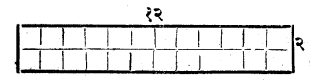


Fig. BGE74p-3g:

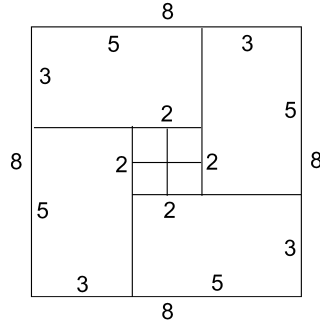
<sup>286</sup>yathā/ AM ] yathā— nyāsaḥ G; two figures (with sides 3 and 5) are missing in G; several numerals

anyat karaṇasūtram vṛttam/64p0/

**caturguṇasya ghātasya yutivargasya cāntaram/  
rāśyantarakṛtes tulyam dvayor avyaktayor yathā//64//**

64

atra rāśī 3/ 5/ anayor yutivargāt caturṣu koṇeṣu ghātacatuṣṭaye 'panīte madhye  
rāśyantaravargasamāni koṣṭhakāni dṛśyanta ity upapannam/ taddarśanam/

//64p//<sup>287</sup>

udāharaṇam/E75p0/

**catvāriṃśad yutir yeṣāṃ doḥkoṭīśravasāṃ vada/  
bhujakoṭivadhō yeṣu śataṃ viṃśatisaṃyutam//E75//<sup>288</sup>**

E75

atra kila bhujakoṭyor vadho dviguṇaḥ 240/ tad yutivargasya vargayogasya cānta-  
ram/ yo hi vargayogaḥ sa eva karṇavargaḥ/ ato bhujakoṭiyutivargasya karṇavargasya

in the remaining two figures in G are missing.

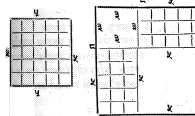
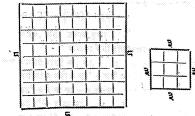
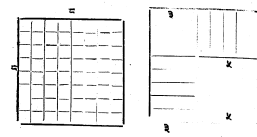


Fig. BG63p-1a:

Fig. BG63p-1g:



<sup>287</sup>samāni koṣṭhakāni AM ] samāḥ koṣṭhakāḥ G; 2 (above the central square in the figure) AM ] 9  
G.

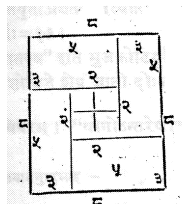


Fig. BG64p-1a:

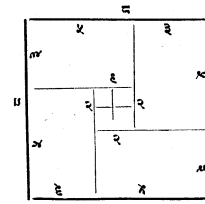


Fig. BG64p-1g:

<sup>288</sup>yutir yeṣāṃ AMGP ] yutiyaṣāṃ T.

cāntaram idaṃ 240 yogāntaraghātasamaṃ syāt/ ata idaṃ antaraṃ 240 yogenānena 40 bhaktaṃ jātaṃ bhujakoṭiyutikarṇāntaram 6/ ‘yogo ’ntareṇonayuto ’rdhitaḥ’ (L 56) ityādinā saṃkramaṇena jāto bhujakoṭiyogaḥ 23/ karṇaḥ 17/ ‘caturguṇasya ghātasya’ (BG 64) iti bhujakoṭiyutivargād asmāt 529 caturguṇaghāte ’smin 480 śodhite śeṣaṃ jāto doḥkoṭyantavargaḥ 49/ asya mūlam 7/ idaṃ doḥkoṭivivaram/ ‘yogo ’ntareṇonayuto ’rdhitaḥ’ (L 56) iti jāte bhujakoṭī 8/ 15//E75p//<sup>289</sup>  
udāharaṇam/E76p0/

**yogo doḥkoṭikarṇānām ṣaṭpañcāśad vadhas tathā/**

E76

**ṣaṭśatī saptabhiḥ kṣuṇṇā yeṣāṃ tān me pṛthag vada//E76//<sup>290</sup>**

atra karṇaḥ yā 1/ asya vargaḥ yāva 1/ sa eva bhujakoṭivargayogaḥ/ atra doḥkoṭikarṇayoge karṇone jāto bhujakoṭiyogaḥ yā 1 rū 56/ trayāṇām ghāte karṇabhakte jāto bhujakoṭivadhaḥ  $\frac{4200}{yā\ 1}$  / atha

**‘vargayogasya yad rāśyor yutivargasya cāntaram/  
dvighnaghātasamānaṃ syāt’ (BG 63abc)**

iti vargayogaḥ yāva 1/ yutivargaḥ yāva 1 yā 112 rū 3136/ anayor antaram yā 112 rū 3136/ etad dvighnaghātasyāsyā  $\frac{8400}{yā\ 1}$  samam iti samacchedikṛtya chedagame jātau pakṣau

$$\begin{array}{|c|c|c|c|c|c|} \hline yāva & 112 & yā & 3136 & rū & 0 \\ \hline yāva & 0 & yā & 0 & rū & 8400 \\ \hline \end{array}$$

etau dvādaśādhikaśatenāpavartya śodhitau jātau

$$\begin{array}{|c|c|c|c|c|c|} \hline yāva & 1 & yā & 28 & rū & 0 \\ \hline yāva & 0 & yā & 0 & rū & 75 \\ \hline \end{array}$$

etāv ṛṇarūpeṇa saṃguṇya caturdaśavargasamarūpāṇi prakṣipyā mūle

$$\begin{array}{|c|c|c|c|} \hline yā & 1 & rū & 14 \\ \hline yā & 0 & rū & 11 \\ \hline \end{array}$$

uktavac chodhane kṛte labdhaṃ yāvattāvanmānam 25/ atra vikalpena dvitīyaṃ karṇamānam 3 utpadyate/ etad anupapannatvān na grāhyam/ atra trayāṇām ghātaḥ 4200/ karṇa 25 bhakto jāto bhujakoṭivadhaḥ 168/ tatheyam bhujakoṭiyutiḥ 31/ ‘caturguṇasya ghātasya’ (BG 64) ityādinā jātaṃ doḥkoṭyantaram 17/ ‘yogo ’ntareṇonayuto ’rdhitaḥ’ (L 56) ityādinā jāte bhujakoṭī 7/ 24//E76p1//<sup>291</sup>

<sup>289</sup>vargayogasya G ] vargayosya AM; karṇavargasya MG ] ∅ A.

<sup>290</sup>śatī AMGP ] śato T; kṣuṇṇā GTP ] kṣuṇā AM.

<sup>291</sup>trayāṇām (1st) AM ] tathā trayāṇām G;  $\frac{4200}{yā\ 1}$  AM ]  $\frac{rū\ 4200}{yā\ 1}$  G; etad dvighna MG ] aita-dvighna A;  $\frac{8400}{yā\ 1}$  AM ]  $\frac{rū\ 8400}{yā\ 1}$  G; caturdaśavarga MG ] caturdaśadharga A; 3 utpadyate AM ] utpadyate 3 G; na grāhyam MG ] na/ grāhyam A; 4200 G ] 42000 AM; yutiḥ 31 AM ] yutiḥ 31 G.

evaṃ sarvatra/ kriyopasaṃhāraṃ kṛtvā matimadbhiḥ kvāpi yuktyaivodāhara-  
 ṇam ānīyate/ avyaktakalpanayā tu mahatī kriyā bhavati//E76p2//  
 iti bhāskariye bījagaṇite 'vyaktavargādisamīkaraṇaṃ samāptam//E76p3//<sup>292</sup>

## II.9 Anekavarṇa-samīkaraṇa

athānekavarṇasamīkaraṇaṃ bījam//65p1//  
 tatra sūtraṃ sārḍhavr̥ttatrayam/65p0/<sup>293</sup>

ādyam varṇam śodhayed anyapakṣād 65  
 anyān rūpāṇy anyataś cādyabhakte/  
 pakṣe 'nyasminn ādyavarṇonmitiḥ syād  
 varṇasyaikasyonmitināṃ bahutve//65//<sup>294</sup>  
 samīkṛtacchedagame tu tābhyas 66  
 tadanyavarṇonmitayaḥ prasādhyāḥ/  
 antyonmitau kuṭṭavidher guṇāptī  
 te bhājyatadbhājakavarṇamāne//66//  
 anye 'pi bhājye yadi santi varṇās 67  
 tanmānam iṣṭam parikalpya sādhye/  
 vilomakotthāpanato 'nyavarṇa-  
 mānāni bhinnam yadi mānam evam//67//  
 bhūyaḥ kāryaḥ kuṭṭako 'trāntyavarṇam 68  
 tenotthāpyotthāpayed vyastam ādyān//68//<sup>295</sup>

idam anekavarṇasamīkaraṇaṃ bījam/ ye 'trodāharāṇe dvitryādayo 'vyakta-  
 rāśayo bhavanti teṣāṃ yāvattāvadādayo varṇā māneṣu kalpyās te 'tra pūrvācāryaiḥ  
 kalpitāḥ/ yāvattāvatkālakaniḥlakapītakalohitakaharitakaśvetakacitrakakapilakapiṅ-  
 galakadhūmrakapāṭalakaśavalakaśyāmalakamecaketyādi/ athavā kādīny akṣarāṇy  
 avyaktānāṃ saṃjñā asaṃkarārthaṃ kalpyāḥ/ ataḥ prāgvad uddeśakālāpavad  
 vidhiṃ kurvātā gaṇakena pakṣau samau kāryau pakṣā vā samāḥ kāryāḥ/ tataḥ

<sup>292</sup>bhāskariye AM ] śrībhāskariye G; bījagaṇite 'vyaktavargādisamīkaraṇaṃ ] bījagaṇite  
 'vyaktavargādisamīkaraṇaṃ (ekavarṇasaṃbandhi madhyamāharaṇaṃ) AM, bījagaṇita ekavarṇa-  
 saṃbandhi madhyamāharaṇaṃ G. The parentheses in AM seem to indicate that the words have  
 been supplied by the editors.

<sup>293</sup>tatra G ] yatra AM.

<sup>294</sup>varṇonmitiḥ AMGP ] varṇonmitaḥ T.

<sup>295</sup>The former half of a Śālinī verse. The latter half is verse 70. kuṭṭako 'trāntyavarṇam  
 AMGTP ] kuṭṭakādanyavarṇas, a variant mentioned by Kṛṣṇa; tenotthāpyotthāpayed vyas-  
 tam ādyān AMG ] tenotthāpyotthāpayedvyastamādyāt P, tenotthāpayedvyastamādyān T,  
 tenotthāpyotthāpayedantimādyān, a variant mentioned by Kṛṣṇa.

sūtrāvatāro 'yam//68p1//<sup>296</sup>

tayoḥ samayor ekasmāt pakṣād itarapakṣasyādyam varṇam śodhayet/ tadanya-  
varṇān rūpāṇi cetarasmāt pakṣāc chodhayet/ tata ādyavarṇaśeṣeṇetarapakṣe bhakte  
bhājakavarṇonmitiḥ/ bahuṣu pakṣeṣu yayor yayoḥ sāmyam asti tayor evaṃ kṛte  
saty anyā unmitayaḥ syuḥ/ tatas tāsūnmitiṣv ekavarṇonmitayo yady anekadhā tatas  
tāsām madhye dvayor dvayoḥ samīkṛtacchedagamena 'ādyam varṇam śodhayet' (BG  
65a) ityādinānyavarṇonmitayaḥ syuḥ//68p2//<sup>297</sup>

evaṃ yāvattāvatsambhavaḥ/ tato 'ntyonmitau bhājyavarṇe yo 'ṅkaḥ sa bhā-  
jyarāśir yo bhājakaḥ sa bhājakaḥ/ rūpāṇi kṣepaḥ/ ataḥ kuṭṭakavidhinā yo guṇa  
utpadyate tad bhājyavarṇamānam/ yā labdhis tad bhājakavarṇamānam/ tayor  
mānayor drḍhabhājakabhājyāv iṣṭena varṇena guṇitau kṣepakau kalpyau/ tataḥ  
svasvamānena sakṣepeṇa pūrvavarṇonmitau varṇāv utthāpya svacchedena hara-  
ṇe yal labhyate tat pūrvavarṇasya mānam/ evaṃ 'vilomakotthāpanato 'nyavarṇa-  
mānāni' (BG 67cd) bhavanti/ yadi tv antyonmitau dvyādayo varṇā bhavanti tadā  
teṣām iṣṭāni mānāni kṛtvā svasvamānais tān utthāpya rūpeṣu prakṣipyā kuṭṭakaḥ  
kāryaḥ//68p3//<sup>298</sup>

atha yadi vilomakotthāpane kriyamāṇe pūrvavarṇonmitau tanmitir bhinnā lab-  
hyate tadā kuṭṭakavidhinā yo guṇa utpadyate sakṣepaḥ sa bhājyavarṇamānam/  
tenāntyavarṇamāneṣu taṃ varṇam utthāpya pūrvonmitiṣu vilomakotthāpana-  
prakāreṇānyavarṇamānāni sādhyāni/ iha yasya varṇasya yan mānam āgataṃ vyak-  
tam avyaktam vyaktāvyaktam vā tasya mānasya vyaktānkena guṇane kṛte tad-  
varṇākṣarasya nirasanam utthāpanam ucyate//68p4//<sup>299</sup>

udāharaṇāni/Q8p0/

'māṇikyāmalanīlamauktikamitir'//Q8//<sup>300</sup>

Q8

iti/ atra māṇikyādīnām maulyāni yāvattāvadādīni prakalpya tadguṇaratnasam-  
khyām ca kṛtvā rūpāṇi ca prakṣipyā samaśodhanārthaṃ nyāsaḥ/

yā	5	kā	8	nī	7	rū	90
yā	7	kā	9	nī	6	rū	62

'ādyam varṇam śodhayet' (BG 65a) ityādinā jātā yāvattāvadunmitir ekaiva

<sup>296</sup>ye 'trodāharaṇe ] yatrodāharaṇe AMG; haritaka AG ] hārataka M; uddeśakālāpavad AM ] udeśa-  
kālāpavad G; pakṣau MG ] pakṣā A.

<sup>297</sup>rūpāṇi cetarasmāt pakṣāc G ] rūpāṇi ca itarapakṣāc AM; '... śodhayet' ityādinā G(-dity-) ]  
...śodhiyedityādinā AM.

<sup>298</sup>yadi tv antyonmitau MG ] yadi tvanyonmitau A.

<sup>299</sup>yo guṇa utpadyate sakṣepaḥ AM ] yo guṇa utpadyate sa kṣepaḥ G, yo guṇaḥ sakṣepa utpadyate  
T(K)P(K); varṇonmitau MG ] varṇenmitau A.

<sup>300</sup>Cited from BG E38. māṇikyāmalanīlamauktikamitir iti AM ] ∅ G (the editor of G supplies the  
full verse of BG E38 here in a pair of parentheses without a verse number).



$$\left| \begin{array}{ccc} \text{kā} & \overset{\bullet}{1} & \text{nī} & 1 & \text{rū} & 28 \\ & & \text{yā} & 2 & & \end{array} \right|$$

ekatvād iyam evāntyā/ ato 'tra kuṭṭakah kāryah/ iha bhājye varṇadvayaṃ var-  
tate/ ato nīlakamānam iṣṭaṃ rūpaṃ 1 kalpitam/ anena nīlakam utthāpya rūpeṣu  
prakṣipya jātam

$$\left| \begin{array}{ccc} \text{kā} & \overset{\bullet}{1} & \text{rū} & 29 \\ & & \text{yā} & 2 \end{array} \right|$$

ataḥ kuṭṭakavidhinā 'harataṣṭe dhanakṣepe' (BG 33a) ityādinā guṇāptī sakṣepe

$$\left| \begin{array}{ccc} \text{pī} & 2 & \text{rū} & 1 \\ \text{pī} & 1 & \text{rū} & 14 \end{array} \right|$$

atra śūnyena pītakam utthāpya jātāni māṅikyādīnāṃ maulyāni 14/ 1/ 1/ atha-  
vaikena 13/ 3/ 1/ dvābhyāṃ vā 12/ 5/ 1/ tribhir vā 11/ 7/ 1/ evam iṣṭavaśād  
ānantyam//68p5//<sup>301</sup>

**'eko bravīti mama dehi śatam'//Q9//<sup>302</sup>**

Q9

iti/ atra dhane yā 1/ kā 1/ paradhanāc chatam apāsyā pūrvadhane śatam prakṣipya  
jātam yā 1 rū 100/ kā 1 rū 100/ paradhanād ādyaṃ dviguṇam iti paradhanena  
dviguṇena samaṃ kṛtvā labdhā yāvattāvadunmitiḥ

$$\left| \begin{array}{ccc} \text{kā} & 2 & \text{rū} & \overset{\bullet}{300} \\ & & \text{yā} & 1 \end{array} \right|$$

punar ādyadhanād daśasv apanīteṣu paradhane kṣipteṣu jātam

$$\left| \begin{array}{ccc} \text{yā} & 1 & \text{rū} & \overset{\bullet}{10} \\ \text{kā} & 1 & \text{rū} & 10 \end{array} \right|$$

ādyād aparah ṣaḍguṇa ity ādyaṃ ṣaḍguṇaṃ parasamaṃ kṛtvā labdham yāvattāvad-  
unmitiḥ

$$\left| \begin{array}{ccc} \text{kā} & 1 & \text{rū} & 70 \\ & & \text{yā} & 6 \end{array} \right|$$

<sup>301</sup>unmitir ekaiva  $\left| \begin{array}{ccc} \text{kā} & \overset{\bullet}{1} & \text{nī} & 1 & \text{rū} & 28 \\ & & \text{yā} & 2 & & \end{array} \right|$  G(here and hereafter without enclosure) ] unmitiḥ

— yā =  $\frac{\text{kā} \overset{\bullet}{1} \text{nī} 1 \text{rū} 28}{2}$  iyamekaiva AM (here and hereafter, AM greatly modify the original  
expression of unmiti in accordance with the modern algebraic notation; G also inserts a horizontal  
bar between the two rows but otherwise preserves the original form); iha AM ] ha G; rūpaṃ 1  
AM ] rūpaṃ G;  $\left| \begin{array}{ccc} \text{kā} & \overset{\bullet}{1} & \text{rū} & 29 \\ & & \text{yā} & 2 \end{array} \right|$  G ] yā =  $\frac{\text{kā} \overset{\bullet}{1} \text{rū} 29}{2}$  AM; athavaikena AM ] athavaikena  
pītakena G.

<sup>302</sup>Cited from BG E39. eko bravīti mama dehi śatam iti ] udāharaṇam/ eko ... iti AM, ∅ G (the  
editor of G supplies 'udāharaṇam' and the full verse of BG E39 here in a pair of parentheses without  
a verse number).

anayoḥ kṛtasamacchedayoś chedagame samīkaraṇam/ tatrānena vaikavarṇatvāt pūrvabījenāgataṃ kālakavarṇamānam 170/ anena yāvattāvadunmānadvaye 'pi kālakam utthāpya rūpāṇi prakṣipyā svacchedena vibhajya labdham yāvattāvanmānam 40//68p6//<sup>303</sup>

udāharaṇam/E77p0/

**aśvāḥ pañcagaṇāṅgamaṅgalamitā yeṣāṃ caturṇāṃ dhanāny**

E77

**uṣṭrās ca dvimuniśrutikṣitimitā aṣṭadvibhūpāvākāḥ/**

**teṣāṃ aśvatarā vṛṣā munimahīnetrendusaṃkhyāḥ kramāt**

**sarve tulyadhanās ca te vada sapady aśvādimaulyāni me//E77//<sup>304</sup>**

atrāśvādīnāṃ maulyāni yāvattāvadādīni prakalpya tadguṇitāyām aśvādisaṃkhyāyām jātāni caturṇāṃ dhanāni/

yā	5	kā	2	nī	8	pī	7
yā	3	kā	7	nī	2	pī	1
yā	6	kā	4	nī	1	pī	2
yā	8	kā	1	nī	3	pī	1

etāni samānīty eṣāṃ prathamadvitīyayoḥ sāmyakaraṇāl labdhā yāvattāvadunmitiḥ

kā	5	nī	6	pī	6
		yā	2		

dvitīyatṛtīyayor apy evaṃ labdhā yāvattāvadunmitiḥ

kā	3	nī	1	pī	1
		yā	3		

evaṃ tṛtīyacaturthayoḥ

kā	3	nī	2	pī	1
		yā	2		

punar āsāṃ madhye prathamadvitīyayoḥ samīkṛtacchedagame sāmyakaraṇena labdhā kālakonmitiḥ

nī	20	pī	16
	kā		9

evaṃ dvitīyatṛtīyayor api

nī	8	pī	5
	kā		3

anayoḥ samacchedīkṛtayoḥ sāmyakaraṇena labdham nīlakonmānam

<sup>303</sup>  $\left[ \begin{array}{ccc} \text{kā} & 2 & \text{rū} & \overset{\bullet}{300} \\ & \text{yā} & 1 & \end{array} \right] \text{G} ] \text{yā} = \text{kā} 2 \text{rū} \overset{\bullet}{300} \text{AM}; \text{unmitiḥ} \left[ \begin{array}{ccc} \text{kā} & 1 & \text{rū} & 70 \\ & \text{yā} & 6 & \end{array} \right] \text{G} ] \text{unmānam}$   
 $\text{yā} = \frac{\text{kā} 1 \text{rū} 70}{6} \text{AM}; 170 \text{G} ] \text{kā} = 170 \text{AM}; \text{yāvattāvanmānam} ] \text{yāvattāvadunmānam} \text{AMG}; 40$   
 $\text{G} ] \text{yā} = 40 \text{AM}.$

<sup>304</sup> mahī AMGP ] mahi T; saṃkhyāḥ AMTP ] saṃkhyā G.

$$\left| \begin{array}{cc} \text{pī} & 31 \\ \text{nī} & 4 \end{array} \right|$$

‘antyonmitau kuṭṭakavidher guṇāptī’ (BG 66c) iti kuṭṭakakaraṇena labdho guṇakaḥ sakṣepaḥ lo 4 rū 0/ etat pītakamānam/ labdhiḥ lo 31 rū 0/ etan nīlakamānam/ kālakonmāne nīlakapītakau svasvamānenotthāpya svacchedena vibhajya labdham kālakamānam lo 76 rū 0/ atha yāvattāvanmāne kālakādīn svasvamānenotthāpya svacchedena vibhajya labdham yāvattāvanmānam lo 85 rū 0/ lohite rūpeṣeṣṭeno-tthāpīte jātāni yāvattāvadādīnām parimāṇāni 85/ 76/ 31/ 4/ dvikeneṣṭena 170/ 152/ 62/ 8/ trikeṇa 255/ 228/ 93/ 12/ evam iṣṭavaśād ānantyam//E77p//<sup>305</sup> udāharaṇam/E78p0/

**tribhiḥ pārāvatāḥ pañca pañcabhiḥ sapta sārasāḥ/** E78  
**saptabhir nava haṁsās ca navabhir barhiṇām trayam//E78//<sup>306</sup>**  
**drammair avāpyate dramaśatena śatam ānaya/** E79  
**eṣām pārāvatādīnām vinodārtham mahīpateḥ//E79//<sup>307</sup>**

atra pārāvatādīnām maulyāni yāvattāvadādīni prakalpya tato ’nupātena pārāvatādīn ānīya tena śatena samakriyā kāryā/ athavā tripañcādīni maulyāni pañca-saptādīn jīvāms ca yāvattāvadādibhiḥ saṁguṇya samakriyā kāryā/ tad yathā/ yā 3 kā 5 nī 7 pī 9/ etāni maulyāni śatasamāni kṛtvā labdham yāvattāvanmānam

$$\left| \begin{array}{cccccc} \text{kā} & \overset{\cdot}{5} & \text{nī} & \overset{\cdot}{7} & \text{pī} & \overset{\cdot}{9} & \text{rū} & 100 \\ & & & \text{yā} & & \text{3} & & \end{array} \right|$$

punaḥ yā 5 kā 7 nī 9 pī 3/ etān jīvān śatasamān kṛtvā labdham yāvattāvanmānam

$$\left| \begin{array}{cccccc} \text{kā} & \overset{\cdot}{7} & \text{nī} & \overset{\cdot}{9} & \text{pī} & \overset{\cdot}{3} & \text{rū} & 100 \\ & & & \text{yā} & & \text{5} & & \end{array} \right|$$

<sup>305</sup>yāvattāvadādīni AM ] yāvattāvadīni G; tadguṇitāyām aśvādisaṁkhyāyām ] tadguṇaguṇitāyām-  
aśvādisaṁkhyāyām MG, tadguṇaguṇitāmaśvādisaṁkhyāyām A;  $\frac{\overset{\cdot}{yā}}{\overset{\cdot}{yā}}$  (in the 1st enclosure) G ]

pradha=yā  
dvidha=yā  
tridha =yā  
cadha =yā  
AM; nī 3 (in the 1st enclosure) AM ] nī 2 G;  $\left| \begin{array}{cccc} \text{kā} & 5 & \text{nī} & \overset{\cdot}{6} \\ & & \text{yā} & \text{2} \end{array} \right|$  G  
] yā =  $\frac{\text{kā } 5 \text{ nī } \overset{\cdot}{6} \text{ pī } \overset{\cdot}{6}}{2}$  AM; apy evaṁ AM ] api G;  $\left| \begin{array}{cccc} \text{kā} & 3 & \text{nī} & \overset{\cdot}{1} \\ & & \text{yā} & \text{3} \end{array} \right|$  G ] yā =  
 $\frac{\text{kā } 3 \text{ nī } \overset{\cdot}{1} \text{ pī } \overset{\cdot}{1}}{3}$  AM;  $\left| \begin{array}{cccc} \text{kā} & 3 & \text{nī} & \overset{\cdot}{2} \\ & & \text{yā} & \text{2} \end{array} \right|$  G ] yā =  $\frac{\text{kā } 3 \text{ nī } \overset{\cdot}{2} \text{ pī } \overset{\cdot}{1}}{2}$  AM; labdhā (3rd) AM  
] ∅ G;  $\left| \begin{array}{ccc} \text{nī} & 20 & \text{pī} \\ \text{kā} & 9 & 16 \end{array} \right|$  G ] kā =  $\frac{\text{nī } 20 \text{ pī } 16}{9}$  AM;  $\left| \begin{array}{ccc} \text{nī} & 8 & \overset{\cdot}{5} \\ \text{kā} & 3 & \text{3} \end{array} \right|$  G ] kā =  $\frac{\text{nī } 8 \text{ pī } \overset{\cdot}{5}}{3}$   
AM; sāmyakaraṇena (2nd) MG ] sāmyakaraṇena A;  $\left| \begin{array}{cc} \text{pī} & 31 \\ \text{nī} & 4 \end{array} \right|$  G ] nī =  $\frac{\text{pī } 31}{4}$  AM; kālakonmāne  
] kālakonmānena AMG.

<sup>306</sup>barhiṇām trayam AMG ] barhiṇas trayāḥ TP (Kṛṣṇa refers to and recommends the former).

<sup>307</sup>drammair AMGP ] drasmair T; dramaśatam AMGP ] drasmaśatam T (here and hereafter T spells drasma for drama).

anayoḥ kṛtasamacchedayoś chedagame labdhaṃ kālakamānam

$$\begin{array}{|c|c|c|c|c|} \hline \overset{\cdot}{nī} & \overset{\cdot}{2} & \overset{\cdot}{pī} & \overset{\cdot}{9} & rū & 50 \\ \hline & & \underset{\cdot}{kā} & \underset{\cdot}{1} & & \\ \hline \end{array}$$

atra bhājye varṇadvayaṃ vartata iti pītakamānam iṣṭaṃ rūpacatuṣṭayaṃ kalpitaṃ/  
anena pītakam utthāpya rūpeṣu prakṣīpya jātān

$$\begin{array}{|c|c|c|c|} \hline \overset{\cdot}{nī} & \overset{\cdot}{2} & rū & 14 \\ \hline & & \underset{\cdot}{kā} & \underset{\cdot}{1} \\ \hline \end{array}$$

ataḥ kuṭṭakavidhinā labdhiguṇau sakṣepau

$$\begin{array}{|c|c|c|c|} \hline lo & \overset{\cdot}{2} & rū & 14 \\ \hline lo & \underset{\cdot}{1} & rū & \underset{\cdot}{0} \\ \hline \end{array}$$

yāvattāvadunmāne svasvamānena kālakādīn utthāpya svasvacchedena vibhajya  
labdhaṃ yāvattāvanmānam lo 1 rū  $\overset{\cdot}{2}/$  lohitakam iṣṭena rūpatrayeṇotthāpya jātāni  
yāvattāvadādīnāṃ mānāni 1/ 8/ 3/ 4/ ebhir maulyāni jīvās cotthāpitāḥ

$$\begin{array}{|c|c|c|c|c|} \hline \text{maulyāni} & 3 & 40 & 21 & 36 \\ \hline \text{pakṣīṇaḥ} & 5 & 56 & 27 & 12 \\ \hline \end{array}$$

athavā catuṣkeṣeṣṭena mānāni 2/ 6/ 4/ 4/ utthāpīte

$$\begin{array}{|c|c|c|c|c|} \hline \text{maulyāni} & 6 & 30 & 28 & 36 \\ \hline \text{jīvās ca} & 10 & 42 & 36 & 12 \\ \hline \end{array}$$

athavā pañcakena mānāni 3/ 4/ 5/ 4/ utthāpīte

$$\begin{array}{|c|c|c|c|c|} \hline \text{maulyāni} & 9 & 20 & 35 & 36 \\ \hline \text{jīvās ca} & 15 & 28 & 45 & 12 \\ \hline \end{array}$$

evam iṣṭavaśād anekadhā//E79p//<sup>308</sup>

udāharaṇam/E80p0/

<sup>308</sup>maulyāni yāvattāvadādīni prakalpya tato 'nupātena pārāvatādīn ānīya tena śatena sama-  
kriyā kāryā/ athavā tripañcādīni maulyāni pañcasaptādīn jīvāś ca yāvattāvadādibhiḥ saṃ-  
guṇya G(mūlyāni for maulyāni) ] maulyāni mūlyaguṇitayāvattāvadādīni prakalpya tato  
'nupātena AM;  $\begin{array}{|c|c|c|c|c|} \hline \overset{\cdot}{kā} & \overset{\cdot}{5} & \overset{\cdot}{nī} & \overset{\cdot}{7} & \overset{\cdot}{pī} & \overset{\cdot}{9} & rū & 100 \\ \hline & & & \underset{\cdot}{yā} & \underset{\cdot}{3} & & & \\ \hline \end{array}$  G ] yā =  $\frac{\overset{\cdot}{kā} \overset{\cdot}{5} \overset{\cdot}{nī} \overset{\cdot}{7} \overset{\cdot}{pī} \overset{\cdot}{9} rū 100}{\underset{\cdot}{3}}$   
AM;  $\begin{array}{|c|c|c|c|c|} \hline \overset{\cdot}{kā} & \overset{\cdot}{7} & \overset{\cdot}{nī} & \overset{\cdot}{9} & \overset{\cdot}{pī} & \overset{\cdot}{3} & rū & 100 \\ \hline & & & \underset{\cdot}{yā} & \underset{\cdot}{5} & & & \\ \hline \end{array}$  G ] yā =  $\frac{\overset{\cdot}{kā} \overset{\cdot}{7} \overset{\cdot}{nī} \overset{\cdot}{9} \overset{\cdot}{pī} \overset{\cdot}{3} rū 100}{\underset{\cdot}{5}}$  A(120 for  
100)M;  $\begin{array}{|c|c|c|c|c|} \hline \overset{\cdot}{nī} & \overset{\cdot}{2} & \overset{\cdot}{pī} & \overset{\cdot}{9} & rū & 50 \\ \hline & & \underset{\cdot}{kā} & \underset{\cdot}{1} & & \\ \hline \end{array}$  G ] kā =  $\overset{\cdot}{nī} \overset{\cdot}{2} \overset{\cdot}{pī} \overset{\cdot}{9} rū 50$  AM; mānam iṣṭaṃ  
MG ] mānaniṣṭaṃ A; kalpitaṃ/ AM ] kalpitaṃ 4 G;  $\begin{array}{|c|c|c|c|} \hline \overset{\cdot}{nī} & \overset{\cdot}{2} & rū & 14 \\ \hline & & \underset{\cdot}{kā} & \underset{\cdot}{1} & 66 \\ \hline \end{array}$  G ]  
kā =  $\overset{\cdot}{nī} \overset{\cdot}{2} rū 14$  AM;  $\begin{array}{|c|c|c|c|} \hline lo & \overset{\cdot}{2} & rū & 14 \\ \hline lo & \underset{\cdot}{1} & rū & \underset{\cdot}{0} \\ \hline \end{array}$  G ]  $\frac{lo \overset{\cdot}{2} rū 14}{lo \underset{\cdot}{1} rū \underset{\cdot}{0}} = \frac{la^\circ}{gu^\circ}$  AM; lo  
1 rū  $\overset{\cdot}{2}$  ] yā = lo 1 rū  $\overset{\cdot}{2}/$  AM, lo 1 rū 2 G;  $\begin{array}{|c|c|c|c|c|} \hline \text{maulyāni} & 3 & 40 & 21 & 36 \\ \hline \text{pakṣīṇaḥ} & 5 & 56 & 27 & 12 \\ \hline \end{array}$   
G ] (pārāvatādayaḥ śātāntarvarttiṇaḥ)  $\frac{\text{pakṣīṇaḥ}}{\text{maulyāni}} \frac{5/}{3/} \frac{56/}{40/} \frac{27/}{21/} \frac{12/}{36/}$  AM; utthāpīte  
 $\begin{array}{|c|c|c|c|c|} \hline \text{maulyāni} & 6 & 30 & 28 & 36 \\ \hline \text{jīvās ca} & 10 & 42 & 36 & 12 \\ \hline \end{array}$  G ] utthāpīte jātāḥ pakṣīṇaḥ śātāntarvarttiṇaḥ 10/ 42/ 36/  
12/ maulyāni 6/ 30/ 28/ 36/ AM; utthāpīte  $\begin{array}{|c|c|c|c|c|} \hline \text{maulyāni} & 9 & 20 & 35 & 36 \\ \hline \text{jīvās ca} & 15 & 28 & 45 & 12 \\ \hline \end{array}$  G(mūlyāni) ]  
ebhirutthāpane kṛte jātāḥ pa 15/ 28/ 45/ 12/ mau 9/ 20/ 35/ 36/ A(15 for 35)M.

ṣaḍbhaktaḥ pañcāgraḥ pañcavibhakto bhavec catuskāgraḥ/  
caturuddhṛtas trikāgro dvyagras trisamuddhṛtaḥ kaḥ syāt//E80//<sup>309</sup> E80

atra rāśiḥ yā 1/ ayaṃ ‘ṣaḍbhaktaḥ pañcāgraḥ’ iti ṣaḍbhir bhāge hriyamāṇe  
kālakō labhyata iti kālakagūṇito haraḥ svāgreṇa pañcakena yuto yāvattāvataḥ sama  
iti sāmyakaraṇena yāvattāvadunmitiḥ

$$\begin{array}{|c|c|c|c|} \hline k\bar{a} & 6 & r\bar{u} & 5 \\ \hline y\bar{a} & & 1 & \\ \hline \end{array}$$

evaṃ pañcādhareṣu nīlakādayo labhyanta iti jātā yāvattāvadunmitayaḥ

$$\begin{array}{|c|c|c|c|} \hline n\bar{i} & 5 & r\bar{u} & 4 \\ \hline y\bar{a} & & 1 & \\ \hline \end{array} \begin{array}{|c|c|c|c|} \hline p\bar{i} & 4 & r\bar{u} & 3 \\ \hline y\bar{a} & & 1 & \\ \hline \end{array} \begin{array}{|c|c|c|c|} \hline l\bar{o} & 3 & r\bar{u} & 2 \\ \hline y\bar{a} & & 1 & \\ \hline \end{array}$$

āsāṃ prathamadvitīyayoḥ samīkaraṇena labdhā kālakonmitiḥ

$$\begin{array}{|c|c|c|c|} \hline n\bar{i} & 5 & r\bar{u} & \overset{\bullet}{1} \\ \hline k\bar{a} & & 6 & \\ \hline \end{array}$$

evaṃ dvitīyatṛtīyayoḥ samīkaraṇena labdhā nīlakonmitiḥ

$$\begin{array}{|c|c|c|c|} \hline p\bar{i} & 4 & r\bar{u} & \overset{\bullet}{1} \\ \hline n\bar{i} & & 5 & \\ \hline \end{array}$$

evaṃ tṛtīyacaturthayoḥ samīkaraṇena labdhā pītakonmitiḥ

$$\begin{array}{|c|c|c|c|} \hline l\bar{o} & 3 & r\bar{u} & \overset{\bullet}{1} \\ \hline p\bar{i} & & 4 & \\ \hline \end{array}$$

ataḥ kuṭṭakāl labdhe lohitakapītakayor māne sakṣepe

$$\begin{array}{|c|c|c|c|c|} \hline h\bar{a} & 4 & r\bar{u} & 3 & l\bar{o} \\ \hline h\bar{a} & 3 & r\bar{u} & 2 & p\bar{i} \\ \hline \end{array}$$

nīlakonmāne pītakaṃ svamānenotthāpya jātam

$$\begin{array}{|c|c|c|c|} \hline h\bar{a} & 12 & r\bar{u} & 7 \\ \hline n\bar{i} & & 54 & \\ \hline \end{array}$$

atra svacchedena haraṇe nīlakamānaṃ bhinnam labhyata iti kṛtvābhinnam kartuṃ  
‘bhūyaḥ kāryaḥ kuṭṭakaḥ’ (BG 68a) iti punaḥ kuṭṭakāt sakṣepo guṇaḥ śve 5 rū 4/  
etad dharitakamānam/ anena lohitakapītakayor mānayoḥ haritakam utthāpya jāte  
lohitakapītakayor māne

$$\begin{array}{|c|c|c|c|c|} \hline ś\bar{v}e & 20 & r\bar{u} & 19 & l\bar{o} \\ \hline ś\bar{v}e & 15 & r\bar{u} & 14 & p\bar{i} \\ \hline \end{array}$$

idānīm nīlakonmāne pītakaṃ svamānenotthāpya svacchedena vibhajya labdham  
nīlakamānam abhinnam śve 12 rū 11/ anena kālakamāne nīlakaṃ svamānenotthāpya

<sup>309</sup>catuskāgraḥ AMGP ] caturagraḥ T; uddhṛtas AMP ] uddhataḥ GT; samuddhṛtaḥ AMGP ]  
samuddhata T.

svacchedena vibhajya labdhaṃ kālakamānam śve 10 rū 9/ ebhir mānair yāvattāvad-  
unmitiṣu kālakādīn utthāpya labdhaṃ yāvattāvanmānam śve 60 rū 59//E80p1//<sup>310</sup>

athavā ‘ṣaḍbhakṭaḥ pañcāgrah’ iti prāgvaj jāto rāśiḥ kā 6 rū 5/ ayam eva  
pañcāpahṛtaś caturagra iti labdhaṃ nīlakam prakalpya tadguṇitahareṇa svāgra-  
yutena nī 5 rū 4 samīkaraṇena jātaṃ kālakamānam

$$\left| \begin{array}{ccc} nī & 5 & rū \dot{1} \\ & kā & 6 \end{array} \right|$$

etat kālakamānaṃ bhinnam labhyata iti kuṭṭakenābhinnakālakonmānam pī 5 rū 4/  
anena pūrvarāśim kā 6 rū 5 utthāpya jātam pī 30 rū 29/ punar ayaṃ caturbhaktas  
tryagra iti prāgvat sāmye kṛte jātam

$$\left| \begin{array}{ccc} lo & 4 & rū \dot{26} \\ & pī & 30 \end{array} \right|$$

atrāpi kuṭṭakāl labdhaṃ pītakamānam ha 2 rū 1/ anena pūrvarāśau pī 30 rū 29  
utthāpīte jāto rāśiḥ ha 60 rū 59/ punar ayaṃ tribhakto dvyagra iti svata eva jātaḥ/  
śūnyaikadvādyutthāpanād bahudhā//E80p2//<sup>311</sup>

udāharaṇam/E81p0/

**syuḥ pañcasaptanavabhiḥ kṣuṇṇeṣu hr̥teṣu keṣu viṃśatyā/  
rūpottarāṇi śeṣāṇy avāptayaś cāpi śeṣasamāḥ//E81//<sup>312</sup>**

E81

atra śeṣāṇi yā 1/ yā 1 rū 1/ yā 1 rū 2/ etā eva labdhayaḥ/ prathamo rāśiḥ kā  
1/ asmāt pañcaguṇitād rāśer labdhiguṇam haram apāsya jātam śeṣam kā 5 yā 20/  
etat yāvattāvatsamaṃ kṛtvā labdhā yāvattāvadunmitiḥ

$$\left| \begin{array}{cc} k\bar{a} & 5 \\ y\bar{a} & 21 \end{array} \right|$$

<sup>310</sup>guṇito AM ] guṇo G;  $\left| \begin{array}{cc} k\bar{a} & 6 \\ y\bar{a} & 1 \end{array} \right| \left| \begin{array}{cc} r\bar{u} & 5 \\ & 1 \end{array} \right|$  G ] yā = k̄a 6 rū 5 AM;  $\left| \begin{array}{cc} n\bar{i} & 5 \\ y\bar{a} & 1 \end{array} \right| \left| \begin{array}{cc} r\bar{u} & 4 \\ & 1 \end{array} \right|$   
 $\left| \begin{array}{cc} p\bar{i} & 4 \\ y\bar{a} & 1 \end{array} \right| \left| \begin{array}{cc} lo & 3 \\ y\bar{a} & 1 \end{array} \right| \left| \begin{array}{cc} r\bar{u} & 2 \\ & 1 \end{array} \right|$  G ] yā = nī 5 rū 4 = pī 4 rū 3 = lo 3 rū 2 AM (lā 3  
for lo 3);  $\left| \begin{array}{cc} n\bar{i} & 5 \\ k\bar{a} & 6 \end{array} \right| \left| \begin{array}{cc} r\bar{u} & \dot{1} \\ & 1 \end{array} \right|$  G ] k̄a =  $\frac{n\bar{i} 5 r\bar{u} \dot{1}}{6}$  AM;  $\left| \begin{array}{cc} p\bar{i} & 4 \\ n\bar{i} & 5 \end{array} \right| \left| \begin{array}{cc} r\bar{u} & \dot{1} \\ & 1 \end{array} \right|$  G ] nī =  $\frac{p\bar{i} 4 r\bar{u} \dot{1}}{5}$   
AM;  $\left| \begin{array}{cc} lo & 3 \\ p\bar{i} & 4 \end{array} \right| \left| \begin{array}{cc} r\bar{u} & \dot{1} \\ & 1 \end{array} \right|$  G ] pī =  $\frac{lo 3 r\bar{u} \dot{1}}{4}$  AM; pītakaṃ G ] ∅ AM;  $\left| \begin{array}{cc} ha & 12 \\ n\bar{i} & 54 \end{array} \right| \left| \begin{array}{cc} r\bar{u} & 7 \\ & 1 \end{array} \right|$  G ] nī  
=  $\frac{ha 12 r\bar{u} 7}{5}$  AM; kāryaḥ kuṭṭakaḥ iti G ] kuṭṭakaḥ kārya iti A, kuṭṭaka kārya iti M; mānāyor ]  
māne AMG; śve 12 rū 11 AM ] śve 12 ha 11 G; mānair MG ] mārnair A.

<sup>311</sup>pañcāpahṛtaś AM ] pañcāhṛtaś G; kālakamānam  $\left| \begin{array}{cc} n\bar{i} & 5 \\ k\bar{a} & 6 \end{array} \right| \left| \begin{array}{cc} r\bar{u} & \dot{1} \\ & 1 \end{array} \right|$  G ] kālakamānam k̄a  
=  $\frac{n\bar{i} 5 r\bar{u} \dot{1}}{6}$  AM; kuṭṭakenābhinnakālakonmānam G ] kuṭṭakenābhinnam kālakonmānam AM;

$\left| \begin{array}{cc} lo & 4 \\ p\bar{i} & 30 \end{array} \right| \left| \begin{array}{cc} r\bar{u} & \dot{26} \\ & 1 \end{array} \right|$  G ] pī =  $\frac{lo 4 r\bar{u} \dot{26}}{30} = \frac{lo 2 r\bar{u} \dot{13}}{15}$  A (13 for 13)M; rāśau pī 30 rū 29 utthāpīte  
AM ] rāśā pī 39 rū 20 vutthāpīte G.

<sup>312</sup>keṣu AMGP ] ∅ T.

atha dvitīyo rāśiḥ nī 1/ asmāt saptaguṇād rūpādhikayāvattāvadguṇaharam apāsya jātam nī 7 yā 20 rū 20/ etad asya yā 1 rū 1 samam kṛtvā labdhā yāvattāvadunmitiḥ

$$\begin{array}{|c|c|c|c|} \hline nī & 7 & rū & 21 \\ \hline & yā & 21 & \\ \hline \end{array}$$

evam tṛtīyaḥ pī 1/ asmān navaguṇāl labdhi yā 1 rū 2 guṇaharam apāsya śeṣam pī 9 yā 21 rū 40/ idam asya yā 1 rū 2 samam kṛtvā labdhā yāvattāvadunmitiḥ

$$\begin{array}{|c|c|c|c|} \hline pī & 9 & rū & 42 \\ \hline & yā & 21 & \\ \hline \end{array}$$

āsām prathamadvitīyayor dvitīyatṛtīyayoḥ sāmīkaraṇena labdhe kālakanīlakayor unmiti

$$\begin{array}{|c|c|c|c|} \hline nī & 7 & rū & 21 \\ \hline & kā & 5 & \\ \hline \end{array} \quad \begin{array}{|c|c|c|c|} \hline pī & 9 & rū & 21 \\ \hline & nī & 7 & \\ \hline \end{array}$$

atra nīlakonmitau kuṭṭakena nīlakapītakayor māne kṛtvā kālakonmitau nīlake svamānenotthāpīte kālakamānaṃ bhinnam labhyata iti kuṭṭakenābhinne kālaka-lohitakayor māne

$$\begin{array}{|c|c|c|c|c|} \hline ha & 63 & rū & 42 & kā \\ \hline ha & 5 & rū & 3 & lo \\ \hline \end{array}$$

atra nīlakapītakayor lohitake svamānenotthāpīte jāte tanmāne

$$\begin{array}{|c|c|c|c|c|} \hline ha & 45 & rū & 33 & nī \\ \hline ha & 35 & rū & 28 & pī \\ \hline \end{array}$$

yathākrameṇa nyāsaḥ/

$$\begin{array}{|c|c|c|c|c|} \hline ha & 63 & rū & 42 & kā \\ \hline ha & 45 & rū & 33 & nī \\ \hline ha & 35 & rū & 28 & pī \\ \hline \end{array}$$

atha yāvattāvadunmitiṣu kālakādīn svasvamānenotthāpya svacchedena vibhajya labdham yāvattāvanmānam ha 15 rū 10/ atra śeṣasame phale na hi śeṣam bhāga-hārādhikam bhavitum arhati/ ato haritakam śūnyenaivotthāpya jātā rāśayaḥ 42/ 33/ 28/ agrāṇi ca 10/ 11/ 12/ etā eva labdhayaḥ//E81p//<sup>313</sup>

udāharaṇam/E82p0/

<sup>313</sup>yā 20 (1st) AM ] yā 20 G;  $\begin{array}{|c|c|} \hline kā & 5 \\ \hline yā & 21 \\ \hline \end{array}$  G ] yā =  $\frac{kā 5}{21}$  AM; rūpādhika MG ] rapādhika A;

$\begin{array}{|c|c|c|c|} \hline nī & 7 & rū & 21 \\ \hline & yā & 21 & \\ \hline \end{array}$  G ] yā =  $\frac{nī 7 rū 21}{21}$  AM; labdhi yā 1 rū 2 guṇa AM ] labdhi (yā 1 rū 2)

guṇa G;  $\begin{array}{|c|c|c|c|} \hline pī & 9 & rū & 42 \\ \hline & yā & 21 & \\ \hline \end{array}$  G ] yā =  $\frac{pī 9 rū 42}{21}$  AM;  $\begin{array}{|c|c|c|c|} \hline nī & 7 & rū & 21 \\ \hline & kā & 5 & \\ \hline \end{array} \quad \begin{array}{|c|c|c|c|} \hline pī & 9 & rū & 21 \\ \hline & nī & 7 & \\ \hline \end{array}$

G ] kā =  $\frac{nī 7 rū 21}{5}$ , nī =  $\frac{pī 9 rū 21}{7}$  AM; kālakalohitakayor AG ] kālakalohitakayor M;

$\begin{array}{|c|c|c|c|c|} \hline ha & 63 & rū & 42 & kā \\ \hline ha & 5 & rū & 3 & lo \\ \hline \end{array}$  G ] kā = ha 63 rū 42 AM;  $\begin{array}{|c|c|c|c|c|} \hline ha & 45 & rū & 33 & nī \\ \hline ha & 35 & rū & 28 & pī \\ \hline \end{array}$  G ]

nī = ha 45 rū 33 AM;  $\begin{array}{|c|c|c|c|c|} \hline ha & 63 & rū & 42 & kā \\ \hline ha & 45 & rū & 33 & nī \\ \hline ha & 35 & rū & 28 & pī \\ \hline \end{array}$  G ] nī = ha 45 rū 33 AM; pī = ha 35 rū 28

AM; ha 15 rū 10 G ] yā = ha 15 rū 10 AM; ato AM ] atra G; śūnyenaivotthāpya AM ] śūnyenotthāpya G.

**ekāgro dvihṛtaḥ kaḥ syād dvikāgras trisamuddhṛtaḥ/** E82  
**trikāgraḥ pañcabhir bhaktas tadvad eva hi labdhayaḥ//E82//<sup>314</sup>**

atra rāsiḥ yā 1/ ayaṃ dvihṛta ekāgra iti tatphalaṃ ca dvihṛtam ekāgram iti phalapramāṇam kā 2 rū 1/ etadguṇaṃ haraṃ svāgreṇa yutaṃ tasya yā 1 samaṃ kṛtvā labdhaṃ yāvattāvanmānam kā 4 rū 3/ asyaikālāpo ghaṭate/ punar api trihṛto dvyagra iti tatphalaṃ ca nī 3 rū 2/ etadguṇaharam agrayutaṃ ca nī 9 rū 8/ idam asya kā 4 rū 3 samaṃ kṛtvā kālakamānaṃ bhinnam kuṭṭakenābhinnam jātam pī 9 rū 8/ anena kālakam utthāpya jāto rāsiḥ pī 36 rū 35/ asyālāpadvayaṃ ghaṭate/ punar ayaṃ pañcabhaktas tryagra iti tatphalaṃ ca lo 5 rū 3/ idam haraguṇam agrayutam asya pī 36 rū 35 samaṃ kṛtvā pītakamānaṃ bhinnam kuṭṭakenābhinnam kṛtvā jātam ha 25 rū 3/ anena pītakam utthāpya jāto rāsiḥ ha 900 rū 143/ haritakasya sūnyā-dinotthāpanenānekavidhaḥ//E82p//<sup>315</sup>

udāharaṇam/E83p0/

**kau rāsi vada pañcaṣaṭkavihṛtāv ekadvikāgrau yayor** E83  
**dvyagram tryuddhṛtam antaram navahṛtā pañcāgrā syād yutiḥ/**  
**ghātaḥ saptahṛtaḥ ṣaḍagra iti tau ṣaṭkāṣṭakābhyāṃ vinā**  
**vidvan kuṭṭakavedikuñjaraghaṭāsamghaṭṭasiṃho 'si cet//E83//<sup>316</sup>**

atra kalpitau rāsi 'pañcaṣaṭkavihṛtāv ekadvikāgrau' yā 5 rū 1/ yā 6 rū 2/ anayor antaram trihṛtam dvyagram iti labdhaṃ kālakas tadguṇaharam agrayutam antareṇānena yā 1 rū 1 samaṃ kṛtvā labdhaṃ yāvattāvanmānam kā 3 rū 1/ anenotthāpitau jātau rāsi kā 15 rū 6/ kā 18 rū 8/ punar anayor yutir navahṛtā pañcāgreti labdhaṃ nīlakas tadguṇaṃ haram agrayutaṃ yogasyāsyā kā 33 rū 14 samaṃ kṛtvā kālakamānaṃ bhinnam

nī	9	rū	9̇
	kā	33	

kuṭṭakenābhinnam jātam pī 3 rū 0/ anenotthāpitau jātau rāsi pī 45 rū 6/ pī 54 rū 8/ punar anayor ghāte vargatvān mahatī kriyā bhavatīti pītakam ekenotthāpya prathamam rāsiḥ vyakta eva kṛtaḥ 51/ punar anayoḥ saptataṣṭayor ghātaḥ saptataṣṭaḥ pī 3 rū 2/ etasya samaṃ kṛtvā prāgvat kuṭṭakenāptaṃ pītakamānam ha 7 rū 6/ anenotthāpito jāto rāsiḥ ha 378 rū 332/ pūrvarāśeḥ kṣepaḥ pī 45 āsīt/ sa haritakenānena ha 7 guṇitas tasya kṣepaḥ syād iti jātaḥ prathamam kṣepaḥ ha 315 rū 51/ athavā prathamam evaikam vyaktam prakalpya dvitīyaḥ sādhyāḥ/ jātau rāsi

<sup>314</sup>samuddhṛtaḥ GP ] samuddhutaḥ A, samuddhataḥ MT.

<sup>315</sup>yā 1 (2nd) AM ] ∅ G; bhinnam (2nd) G ] ∅ AM; vidhaḥ G ] vidhāḥ AM.

<sup>316</sup>samghaṭṭa AMGP ] samga T.



rū 51/ śve 126 rū 80//E83p//<sup>317</sup>  
udāharaṇam/E84p0/

**navabhiḥ saptabhiḥ kṣuṇṇaḥ**  
**ko rāśis triṃśatā hṛtaḥ/**  
**yadagraikyam phalaikyādhyam**  
**bhvet ṣaḍviṃśater mitam//E84//<sup>318</sup>**

E84

atraikaharatvāc cheṣayoḥ phalayor yutidarśanāc ca guṇayogo guṇakaḥ kalpitaḥ  
rū 16/ rāśiḥ yā 1/ labdhaikyapramāṇam kālakas tadguṇitam haram guṇaguṇitād  
rāśer apāsyā jātam śeṣam yā 16 kā 30/ etat phalena kālakena yutam yā 16 kā 29  
ṣaḍviṃśatisamam kṛtvā kuṭṭakena prāgvaj jātam yāvattāvanmānam nī 29 rū 27/  
atra labdhyagrayogasyaikatānirdeśāt kṣepo na deyaḥ//E84p//<sup>319</sup>  
udāharaṇam/E85p0/<sup>320</sup>

**kas trisaptanavakṣuṇṇo rāśis triṃśadvibhājitaḥ/**  
**yadagraikyam api triṃśaddhṛtam ekādaśāgrakam//E85//**

E85

atrāpi guṇayogo guṇaḥ prāgvat rū 19/ rāśiḥ yā 1/ labdham kālakaḥ kā 1/  
etadguṇam haram guṇaguṇitād rāśer apāsyā śeṣam yā 19 kā 30/ etad agraikyam  
triṃśattaṣṭam eva/ tataḥ prathamālāpe dvitīyālāpasyāntarbhūtāt vād idam evai-  
kādaśasamam kṛtvā prāgvaj jāto rāśiḥ nī 30 rū 29//E85p//<sup>321</sup>  
udāharaṇam/E86p0/

**kas trayoviṃśatikṣuṇṇaḥ ṣaṣṭyāśītyā hṛtaḥ pṛthak/**  
**yadagraikyam śatam dṛṣṭam kuṭṭakajña vadāsu tam//E86//**

E86

atra sūtram vṛttam/69p0/

**atraikādhikavarṇasya bhājyasthasyepsitā mitiḥ/**

69

<sup>317</sup>  $\left[ \begin{array}{ccc} nī & 9 & rū \\ k̄a & 33 & 9 \end{array} \right] G ] k̄a = \frac{nī 9 rū 9}{33} AM; etasya AM ] \emptyset G; ha 7 rū 6/ anenothāpito jāto rāśiḥ G ] \emptyset AM; prathamam evaikam G ] prathamamekam AM; sādhyah/ ] sādhyo vā AM, sādhyah/ vā G; śve 126 AM ] ha 126 G.$

<sup>318</sup> agraikyam MGTP ] agraṅkyam A; phalaikyādhyam AMGP ] phalaikādyam T; ṣaḍviṃśater MGTP ] ṣaḍviṃśate A.

<sup>319</sup> yutidarśanāc AM ] yutirdarśanāc G.

<sup>320</sup> udāharaṇam G ] \emptyset AM.

<sup>321</sup> kā 1 ] \emptyset AM, 1 G.

**bhāgalabdhasya no kalpyā kriyā vyabhicaret tathā//69//<sup>322</sup>**

ato 'nyathā yatitavyam/ atra svasvabhāgahārān nyūne śeṣe yathā bhavato yathā cākhilam syāt tathā śeṣayogaṃ vibhajya kriyā kāryā/ tathā kalpīte śeṣe 40/ 60/ rāśiḥ yā 1/ eṣa trayaviṃśatiguṇaḥ ṣaṣṭihṛtaḥ phalaṃ kālakaś tadguṇaṃ haram śeṣayutam asya yā 23 samaṃ kṛtvā labdham yāvattāvanmānam

$$\begin{array}{|c|c|c|c|} \hline k\bar{a} & 60 & r\bar{u} & 40 \\ \hline y\bar{a} & 23 & & \\ \hline \end{array}$$

evam anyat

$$\begin{array}{|c|c|c|c|} \hline n\bar{i} & 80 & r\bar{u} & 60 \\ \hline y\bar{a} & 23 & & \\ \hline \end{array}$$

anayoḥ samīkaraṇe kuṭṭakena labdhe kālakanīlakamāne

$$\begin{array}{|c|c|c|c|c|} \hline p\bar{i} & 4 & r\bar{u} & 3 & k\bar{a} \\ \hline p\bar{i} & 3 & r\bar{u} & 2 & n\bar{i} \\ \hline \end{array}$$

ābhyām utthāpane yāvattāvanmānaṃ bhinnaṃ syād iti kuṭṭakenābhinnaṃ jātam lo 240 rū 20/ athavā śeṣe 30/ 70/ ābhyām rāśiḥ lo 240 rū 90//E86p//<sup>323</sup>  
udāharaṇam/E87p0/

**kaḥ pañcaguṇito rāśis trayodaśavibhājitaḥ/ E87**  
**yal labdham rāśinā yuktaṃ triṃśaj jātaṃ vadāsu tam//E87//<sup>324</sup>**

atra rāśiḥ yā 1/ eṣa pañcaguṇaś trayodaśahṛtaḥ phalaṃ kālakaḥ 1/ etat phalaṃ rāśiyutaṃ yā 1 kā 1 triṃśatsamaṃ kriyata ity uktam/ yata iyaṃ kriyā nirādhārā nātra guṇo na ca hara upalabhyate/ tathā coktam/

**'nirādhārā kriyā yatrāniyatādhārikāpi vā/ Q10**  
**na tatra yojayet tām tu katham vā sā pravartate'//Q10//<sup>325</sup>**

ato 'trānyathā yatitavyam/ atra kila haratulye rāśau kalpīte 13/ rāśiphala- yogenānena 18 yadīdam 5 phalaṃ tadā triṃśatā kim iti labdham phalam  $\frac{25}{3}$  / etat triṃśato 'pāśya śeṣaṃ jāto rāśiḥ  $\frac{65}{3}$  //E87p//  
atrādyodāharaṇam/E88p0/

**ṣaḍaṣṭaśatakāḥ kṛtvā samārghena phalāni ye/ E88**

<sup>322</sup>atraikādhikavarṇasya G ] yatraikādhikavarṇasya A(barṇa)M, atrādhikasya varṇasya TP; bhājya- sthasyepsitā AMGP ] bhājyasyepsitā T.

<sup>323</sup>svasvabhāgahārān nyūne M ] svasvabhāgahārāngyūne A, svasvabhāgahārānyūne G; cākhilam AM ] ca khilam na G;  $\begin{array}{|c|c|c|c|} \hline k\bar{a} & 60 & r\bar{u} & 40 \\ \hline y\bar{a} & 23 & & \\ \hline \end{array}$  G ] yā =  $\frac{k\bar{a} 60 r\bar{u} 40}{23}$  AM;  $\begin{array}{|c|c|c|c|} \hline n\bar{i} & 80 & r\bar{u} & 60 \\ \hline y\bar{a} & 23 & & \\ \hline \end{array}$  G ] yā

**vikriya ca punaḥ śeṣam ekaikaṃ pañcabhiḥ paṇaiḥ/  
jātāḥ samapaṇās teṣāṃ kaḥ krayo vikrayas ca kaḥ//E88//<sup>326</sup>**

<sup>327</sup>atra krayaḥ yā 1/ vikraya iṣṭaṃ daśādhikaśatam 110/ krayaḥ ṣaḍguṇito vikrayeṇa hr̥to labdhiḥ kālakaḥ 1/ labdhiguṇaṃ haram ṣaḍguṇitād rāśer apāsya jātam yā 6 kā 110/ idam pañcaguṇaṃ labdhiyutaṃ jātāḥ prathamasya paṇāḥ yā 30 kā 549/ evaṃ dvitīyatr̥tīyayor api paṇāḥ sādhyāḥ/ tatra labdhir anupātena/ yadi ṣaṇṇāṃ kālakas tadāṣṭānāṃ śatasya ca kim iti labdhir aṣṭānāṃ kā  $\frac{4}{3}$  / śatasya ca kā  $\frac{50}{3}$  / labdhiguṇaṃ haram bhājyād apāsya śeṣaṃ pañcaguṇaṃ labdhiyutaṃ jātā dvitīyasya paṇāḥ yā  $\frac{120}{3}$  kā  $\frac{2196}{3}$  / evaṃ tr̥tīyasya paṇāḥ yā  $\frac{1500}{3}$  kā  $\frac{27450}{3}$  / ete sarve samā iti samacchedikṛtya chedagame prathamadvitīyapakṣayor dvitīyatr̥tīyayoḥ prathamatr̥tīyayoś ca samīkaraṇena labdhā yāvattāvadunmitis tulyaiva

$$\left[ \begin{array}{l} \text{kā} \quad 549 \\ \text{yā} \quad 30 \end{array} \right]$$

atra kuṭṭakāl labdham yāvattāvanmānam nī 549 rū 0/ nīlakam ekenotthāpya jātaḥ krayaḥ 549/ samadhanam//E88p1//<sup>328</sup>

idam aniyatādhārikriyāyām ādyair udāhṛtya yathākathaṃcit samīkaraṇaṃ kṛtvānītam/ iyaṃ tathā kalpanā kṛtā yathātrānīyatādhārāyām api niyatādhārikriyāvat phalam āgacchati/ evaṃvidhakalpanāc ca kriyāsaṃkocād yatra vyabhicarati tatra buddhimadbhir buddhyā saṃdheyam/ tathā coktam/<sup>329</sup>

$$= \frac{\text{nī } 80 \text{ rū } 60}{23} \text{ AM; } \left[ \begin{array}{l} \text{pī} \quad 4 \quad \text{rū} \quad 3 \quad \text{kā} \\ \text{pī} \quad 3 \quad \text{rū} \quad 2 \quad \text{nī} \end{array} \right] \text{ G } \left[ \begin{array}{l} \text{kā} = \text{pī} \quad 4 \quad \text{rū} \quad 3 \\ \text{nī} = \text{pī} \quad 3 \quad \text{rū} \quad 2 \end{array} \right] \text{ AM.}$$

<sup>324</sup>jātaṃ AMTP ] jāta G.

<sup>325</sup>Source unidentified. yatrānīyatādhārikāpi G ] yatra niyatādhārikāpi AM; vā sā G ] sā vā AM.

<sup>326</sup>śatakāḥ AMGTP ] daśakāḥ, a variant mentioned by Kṛṣṇa, who gives a solution to this version also; samārghena AMGP ] samārdhena T; phalāni AMGTP ] dalāni, a variant mentioned by Kṛṣṇa.

<sup>327</sup>E88p1–p3 are missing in A.

<sup>328</sup>daśādhikaśatam M ] daśādhikaṃ śatam GP(K), daśādhikaṃ ca śatam T(K); kālakaḥ 1 MG ] kālakaḥ kā 1 T(K)P(K); apāsya jātam MG ] apanīya śeṣaṃ T(K)P(K); śatasya ca kim MGP(K) ] śatasya kim T(K); śeṣaṃ pañcaguṇaṃ labdhiyutaṃ MG ] prāgvaj T(K), tataḥ prāgvaj P(K); yā  $\frac{120}{3}$  kā  $\frac{2196}{3}$  GT(K) ] yā  $\frac{120}{3}$  kā  $\frac{2194}{3}$  M, yā 120 kā 2196 P(K); evaṃ tr̥tīyasya paṇāḥ T(K)P(K) ] evaṃ tr̥tīyasya MG; yā  $\frac{1500}{3}$  kā  $\frac{27450}{3}$  M(with horizontal bars) ] yā  $\frac{1500}{3}$  kā  $\frac{2745}{3}$  G,  $\frac{1500}{3}$  kā  $\frac{27450}{3}$  T(K), yā 1500 kā 27450 P(K); prathamatr̥tīyayoś ca samīkaraṇena T(K)P(K) ] samīkaraṇena ca MG;  $\left[ \begin{array}{l} \text{kā} \quad 549 \\ \text{yā} \quad 30 \end{array} \right]$  GT(K)P(K) ] yā =  $\frac{\text{kā } 549}{30}$  M; kuṭṭakāl labdham MG ] kuṭṭakalabdham T(K)P(K); nī 549 rū 0 MGT(K) ]  $\frac{\text{nī } 549 \text{ rū } 0}{22}$  P(K); krayaḥ 549 MGP(K) ] krayāḥ 549 T(K).

<sup>329</sup>kriyāsaṃkocād M ] kriyā saṃkocād G; tathā coktam G ] ∅ M.

‘ālāpo matir amalāvyaktānām kalpanā samīkaraṇam/  
trairāśīkam iti bīje sarvatra bhavet kriyāhetuḥ’//Q11//<sup>330</sup> Q11

//E88p2//

iti bhāskarīye bījagaṇite ’nekavarṇasamīkaraṇam samāptam//E88p3//<sup>331</sup>

## II.10 Anekavarṇa-madhyamāharaṇa

athānekavarṇamadhyamāharaṇabhedāḥ//70p1//<sup>332</sup>

tatra ślokkottarārdhād ārabhya sūtram sārḍhavr̥ttatrayam/70p0/

vargādyaṃ cet tulyāśuddhau kṛtāyāṃ	70
pakṣasyaikasyoktavad vargamūlam//70// <sup>333</sup>	
vargaprakṛtyāparapakṣamūlam	71
tayoḥ samīkāravidhiḥ punaś ca/ vargaprakṛtyā viśayo na cet syāt	
tadānyavarṇasya kṛteḥ samaṃ tam//71// <sup>334</sup>	
kṛtvāparaṃ pakṣam athānyamānaṃ	72
kṛtiprakṛtyādyamitis tathā ca/ vargaprakṛtyā viśayo yathā syāt	
tathā sudhībhir bahudhā vicintyam//72// <sup>335</sup>	
bījaṃ matir vividhavarṇasahāyanī hi	73
mandāvabodhavidhaye vibudhair nijādyaiḥ/ vistāritā gaṇakatāmarasāṃśumadbhir yā saiva bījagaṇitāhvayatām upetā//73// <sup>336</sup>	

yatra pakṣayoḥ samaśodhane kṛte saty avyaktavargādīkam avaśeṣaṃ bhavati tatra pūrvavat ‘pakṣau tadeṣṭena nihatyā’ (BG 59b) ityādinaikasya pakṣasya mūlam grāhyam/ anyapakṣe yady avyaktavargaḥ sarūpo vartate tadā tasya pakṣasya vargaprakṛtyā mūle sādhye/ tatra varṇavarge yo ’nkaḥ sā prakṛtiḥ/ rūpāṇi kṣepaḥ prakalpyaḥ/ evaṃ yat kaniṣṭhapadaṃ tat prakṛtivarṇamānaṃ/ yaj jyeṣṭhaṃ tad asya vargasya mūlam/ atas tat pūrvapakṣamūlena samaṃ kṛtvā pūrvavarṇamānaṃ

<sup>330</sup>Source unidentified.

<sup>331</sup>bhāskarīye ] śrībhāskarīye MG; samāptam M ] ∅ G.

<sup>332</sup>athānekavarṇamadhyamāharaṇabhedāḥ AMG ] atha madhyamāharaṇabhedāḥ T, anekavarṇa-samīkaraṇāntargataṃ madhyamāharaṇam P.

<sup>333</sup>The latter half of a Śālinī verse. The former half is verse 68.

<sup>334</sup>samīkāra AMGP ] samīkara T.

<sup>335</sup>bahudhā AMGP ] bahudā T.

<sup>336</sup>sahāyanī hi AMTP ] sahāyanīha G; upetā AMGP ] upaiti T.

sādhyam//73p1//<sup>337</sup>

atha yady anyapakṣe 'vyaktavargaḥ sāvyakto 'vyaktam eva sarūpam arūpaṃ vā  
vartate tadā vargaprakṛter na viṣayaḥ/ katham tatra mūlam ity ata āha/ 'varga-  
prakṛtyā' (BG 71c) iti/ tadānyavarṇavargasamaṃ kṛtvā prāgvad ekasya pakṣasya  
mūlaṃ grāhyam/ tadanyapakṣasya vargaprakṛtyā mūle sādhye/ tatrāpi kaniṣṭhaṃ  
prakṛtivarṇamānaṃ jyeṣṭhaṃ tatpakṣasya padam iti padānāṃ yathocitaṃ samī-  
karaṇaṃ kṛtvā varṇamānāni sādhyāni//73p2//<sup>338</sup>

atha yadi dvitīyapakṣe tathābhūte 'pi na viṣayas tadā yathā yathā vargaprakṛtyā  
viṣayo bhavati tathā tathā buddhimadbhir buddhyā vidhāyavyaktamānāni jñā-  
tavyāni/ yadi buddhyaiva jñātavyāni tarhi bījena kim ity āśaṅkyāha/ 'bijaṃ matir'  
(BG 73a) iti/ hi yasmāt kāraṇāt/ buddhir eva pāramārthikaṃ bijaṃ/ varṇas  
tu tatsahāyāḥ/ gaṇakakamalatigmarasṃmibhir ādyair ācāryair mandāvabodhārtham  
ātmiyā yā matir vividhavarṇān saḥāyān kṛtvā vistāraṃ nītā saiveha samprati  
bījagaṇitasamjñāṃ gatā/ idaṃ kila siddhānte mūlasūtraṃ samkṣiptam uktaṃ  
bālāvabodhārtham kiṃcid vistāryocyate//73p3//<sup>339</sup>

sūtraṃ vṛttadvayam/74p0/<sup>340</sup>

**ekasya pakṣasya pade gr̥hīte**

**dvitīyapakṣe yadi rūpayuktaḥ/**

74

**avyaktavargo 'tra kṛtiprakṛtyā**

**sādhye tadā jyeṣṭhakaniṣṭhamūle//74//<sup>341</sup>**

**jyeṣṭhaṃ tayoḥ prathamapakṣapadena tulyaṃ**

75

**kṛtvoktavat prathamavarṇamitiḥ prasādhyā/**

**hrasvaṃ bhavet prakṛtivarṇamitiḥ sudhībhir**

**evaṃ kṛtiprakṛtir atra niyojanīyā//75//<sup>342</sup>**

asyārtho vyākhyāta eva//75p//<sup>343</sup>

udāharaṇam/E89p0/

**ko rāsir dviguṇo rāsivargaiḥ ṣaḍbhiḥ samanvitaḥ/**

E89

<sup>337</sup>samaśodhane G ] śodhane AM; tad asya G ] tasya AM.

<sup>338</sup>anyapakṣe 'vyaktavargaḥ ] anyapakṣe vyaktavargaḥ AMG; varṇamānāni MG ] varṇamanāni A.

<sup>339</sup>tathābhūte 'pi ] tathābhūto 'pi AM, tathābhūtamapi G; saiveha AM ] saiva G; siddhānte MG ]  
siddhante A; vistāryocyate G ] vistāryocyate AM. G includes the last sentence (idaṃ ... vistāryo-  
cyate) in 74p0. 'mūlasūtra' seems to refer to GA praśna 5 cited in E43p2 above (Q2).

<sup>340</sup>vṛttadvayam AM ] ∅ G.

<sup>341</sup>tadā TP ] tathā AMG.

<sup>342</sup>mitiḥ prasādhyā TP ] mitistu sādhyā AMG.

<sup>343</sup>asyārtho vyākhyāta eva G ] ∅ AM.

**mūlado jāyate bījagaṇitajña vadāsu tam//E89//<sup>344</sup>**

atra yāvattāvadrāsir dviguṇo vargaiḥ ṣaḍbhiḥ samanvitaḥ yāva 6 yā 2/ eṣa varga itī kālakavargeṇa samīkaraṇārtham nyāsaḥ/

yāva	6	yā	2	kāva	0
yāva	0	yā	0	kāva	1

atra samaśodhane jātau pakṣau

yāva	6	yā	2
	kāva	1	

athaitau ṣaḍbhiḥ saṃguṇya rūpaṃ prakṣipyā prāgvat prathamapakṣamūlam yā 6 rū 1/ atha dvitīyapakṣasyāsyā kāva 6 rū 1 vargaprakṛtyā mūle ka 2 jye 5 vā ka 20 jye 49/ jyeṣṭham prathamapakṣapadenānena yā 6 rū 1 samaṃ kṛtvā labdham yāvattāvanmānam  $\frac{2}{3}$  vā 8/ hrasvaṃ prakṛtivarṇasya kālakasya mānam 2 vā 20/ evaṃ kaniṣṭhajyeṣṭhavaśād bahudhā//E89p//<sup>345</sup>

ādyodāharaṇam/E90p0/

**rāśiyogakṛtir miśrā rāśyor yogaghanena cet/**

E90

**dvighnasya ghanayogasya sā tulyā gaṇakocyatām//E90//<sup>346</sup>**

atra kriyā yathā na vistāram eti tathā buddhimatā rāśī kalpyau/ tathā kalpītau yā 1 kā 1/ yā 1 kā 1/ anayor yogaḥ yā 2/ asya kṛtir asyaiva ghanena miśrā yāgha 8 yāva 4/ atha rāśyoh pṛthag ghanau/ prathamasya yāgha 1 yāvakābhā 3 kāvayābhā 3 kāgha 1/ dvitīyasya yāgha 1 yāvakābhā 3 kāvayābhā 3 kāgha 1/ anayor yogaḥ yāgha 2 kāvayābhā 6/ dvighnaḥ yāgha 4 kāvayābhā 12/ samaśodhanārtham nyāsaḥ/

yāgha	8	yāva	4	kāvayābhā	0
yāgha	4	yāva	0	kāvayābhā	12

samaśodhane kṛte pakṣau yāvattāvātāpavartya rūpaṃ prakṣipyā prathamapakṣamūlam yā 2 rū 1/ parapakṣasyāsyā kāva 12 rū 1 vargaprakṛtyā mūle ka 2 jye 7 vā ka 28 jye 97/ kaniṣṭham kālakamānam/ jyeṣṭham asya yā 2 rū 1 samaṃ kṛtvā labdham yāvattāvanmānam 3 vā 48/ svasvamānenotthāpane kṛte jātau rāśī 1/ 5/ vā 20/ 76/ ityādi//E90p//<sup>347</sup>

athānyat sūtraṃ sārḍhavr̥ttam/76p0/

**dvitīyapakṣam sati saṃbhavē tu**

76

<sup>344</sup>jāyate AGTP ] jāyaye M.

<sup>345</sup>iti G ] iti iti AM; 

yāva	6	yā	2
	kāva	1	

 G ] yāva 6 yā 2, kāva 1/ AM.

<sup>346</sup>ghanena AMGT(cor) ] dhanena TP; cet AMG ] ca TP.

<sup>347</sup>atra MG ] atha A; yā 1 kā 1/ yā 1 kā 1/ G ] (yā 1 kā 1), (yā 1 kā 1)/ AM; yāvakābhā (twice) G ] yāva.kābhā AM; kāvayābhā (five times) G ] kāva.yābhā AM; kāvayābhā (twice in the table) AM ] yāvakābhā G; jye 97 AM ] 97 G; 1/ 5/ AM ] 5/ 1 G.

kr̥tyāpavartyātra pade prasādhye/  
 jyeṣṭham kaniṣṭhena tadā nihanyāc  
 ced vargavargeṇa kṛto 'pavartaḥ//76//<sup>348</sup>  
 kaniṣṭhavargeṇa tadā nihanyāj  
 jyeṣṭham tataḥ pūrvavad eva śeṣam//77ab/

77ab

spasṭārtham//77abp//  
 udāharaṇam/E91p0/

yasya vargakṛtiḥ pañcaguṇā vargaśatonitā/  
 mūladā jāyate rāśiṃ gaṇitajña vadāsu tam//E91//

E91

atra rāśiḥ yā 1/ asya 'vargakṛtiḥ pañcaguṇā' vargaśatenonā yāvava 5 yāva 100/  
 ayam varga iti kālakavargasamaṃ kṛtvā gr̥hītaṃ kālakavargasya mūlam kā 1/  
 dvitīyapakṣasyāsyā yāvava 5 yāva 100 yāvattāvadvargeṇāpavartya vargaprakṛtyā  
 mūle ka 10 jye 20/ vā ka 170 jye 380/ kṛtyāpavarte kṛte 'jyeṣṭham kaniṣṭhena tadā  
 nihanyāt' (BG 76c) iti jātam jye 200/ vā jye 64600/ idaṃ kālakamānam/ kaniṣṭham  
 prakṛtivarṇamānam sa eva rāśiḥ 10 vā 170//E91p//<sup>349</sup>  
 udāharaṇam/E92p0/

kayoḥ syād antare vargo vargayogo yayor ghanah/  
 tau rāśi kathayābhinnau bahudhā bījavittama//E92//

E92

atra rāśi yā 1 kā 1/ anayor antaram yā 1 kā 1 nīlakavargasamaṃ kṛtvā labdham  
 yāvattāvanmānam kā 1 nīva 1/ anena yāvattāvad utthāpya jātau rāśi kā 1 nīva  
 1/ kā 1/ anayor vargayogaḥ kāva 2 nīvakābhā 2 nīvava 1/ eṣa ghana iti nīlaka-  
 vargaghanasamaṃ kṛtvā śodhane kṛte jātam prathamapakṣe nīvagha 1 nīvava 1/  
 dvitīyapakṣe kāva 2 nīvakābhā 2/ pakṣau dvābhyāṃ saṃguṇya nīlakavargavargam  
 prakṣipyā dvitīyapakṣasya mūlam kā 2 nīva 1/ prathamapakṣam nīvagha 2 nīvava  
 1 nīlakavargavargeṇāpavartya jātam nīva 2 rū 1/ atra vargaprakṛtyā mūle ka 5 jye  
 7/ vā ka 29 jye 41/ 'ced vargavargeṇa kṛto 'pavartaḥ kaniṣṭhavargeṇa tadā nihanyāj  
 jyeṣṭham' (BG 76d–77b) iti jātam jye 175 vā jye 34481/ kaniṣṭham nīlakamānam/  
 tenotthāpitaṃ prānmūlam jātam kā 2 rū 25 vā kā 2 rū 841/ idaṃ jyeṣṭhamūla-  
 samaṃ kṛtvā labdham kālakamānam 100 vā 17661/ svasvamānenotthāpya jātau

<sup>348</sup>dvitīyapakṣam G ] dvitīyapakṣe AMG(Ms)TP(Kṛṣṇa recommends the former); tadā AMGT ]  
 tathā P.

<sup>349</sup>śatenonā AM ] śatonā G; yāvava 5 (1st) AM ] yāvava 1 G.

rāśi 75/ 100/ vā 16820/ 17661 ityādi//E92p//<sup>350</sup>  
 anyat sūtram sārḍhavṛttam/77cdp0/

**sāvvyaktarūpo yadi varṇavargas** 77cd  
**tadānyavarṇasya kṛteḥ samaṁ tam//77cd//<sup>351</sup>**  
**kṛtvā padaṁ tasya tadanyapakṣe** 78  
**vargaprakṛtyoktavād eva mūle/**  
**kaniṣṭham ādyena padena tulyaṁ**  
**jyeṣṭham dvitīyena samaṁ vidadhyāt//78//**

atra prathamapakṣamūle gr̥hīte saty anyapakṣe sāvvyaktāvvyaktakṛtiḥ sarūpārūpā  
 vā bhavati tatrādyapakṣasyānyavarṇavargasamīkaraṇaṁ kṛtvā mūlaṁ grāhyam/  
 tadanyapakṣasya varḡaprakṛtyā mūle/ tayoḥ kaniṣṭham ādyasya padena jyeṣṭham  
 dvitīyapakṣapadena ca samaṁ kṛtvā varṇamāne sādhye //78p//<sup>352</sup>  
 udāharaṇam/E93p0/

**trikādidvyuttaraśreḍhyām gacche kvāpi ca yat phalam/** E93  
**tad eva triguṇaṁ kasminn anyagacche bhaved vada//E93//<sup>353</sup>**

atra śreḍhyor nyāsaḥ/ ādiḥ 3/ cayaḥ 2/ gacchaḥ yā 1/ ādiḥ 3/ cayaḥ 2/ gacchaḥ  
 kā 1/ anayoḥ phale yāva 1 yā 2/ kāva 1 kā 2/ anayor ādyam triguṇaṁ parasamaṁ  
 kṛtvā śodhanārtham nyāsaḥ/

yāva	3	yā	6
kāva	1	kā	2

śodhane kṛte pakṣau triguṇīkṛtya nava prakṣipyā prathamapakṣasya mūlam yā 3  
 rū 3/ dvitīyapakṣasyāsyā kāva 3 kā 6 rū 9 nīlakavargeṇa sāmīyam kṛtvā tathaiva  
 pakṣau triguṇīkṛtyarṇam aṣṭādaśa prakṣipyā mūlam kā 3 rū 3/ tadanyapakṣasyāsyā  
 nīva 3 rū 18 varḡaprakṛtyā mūle ka 9/ jye 15/ vā ka 33/ jye 57/ kaniṣṭham ādyenā-  
 nena yā 3 rū 3 samaṁ kṛtvā labdhe yāvattāvatkālakamāne 2/ 4/ vā 10/ 18/ evaṁ  
 sarvatra//E93p//<sup>354</sup>

athānyat sūtram vṛttadvayam/79p0/

**sarūpake varṇakṛtī tu yatra** 79

<sup>350</sup>atra (1st) G ] atha AM; nīvakābhā (twice) G ] nīva.kābhā AM; pakṣau G ] pakṣām AM; jātam  
 nīva AM ] nīva G; jye 175 G ] jeṣṭham 175 AM.

<sup>351</sup>sāvvyaktarūpo AMTP ] sāvvyaktavargo G; tadānyavarṇasya AMGP ] tadānyavargasya T.

<sup>352</sup>sarūpārūpā vā AM ] sarūpā vā G; kṛtvā mūlaṁ grāhyam/ tadanyapakṣasya varḡaprakṛtyā mūle  
 G ] kṛtvā mūle AM.

<sup>353</sup>trikādidvyuttara MGTP ] trikādyuttara A.

<sup>354</sup>anayor ādyam MG ] ranayorādyam A; yā 3 rū 3 (1st) AM ] yā 3 rū 2 G; rū 18 G ] rū 18 AM.



tatrecchayaikāṃ prakṛtiṃ prakalpya/  
 śeṣaṃ tataḥ kṣepakam uktavac ca  
 mūle vidadhyād asakṛt samatve//79//  
 sabhāvite varṇakṛtī tu yatra  
 tanmūlam ādāya ca śeṣakasya/  
 iṣṭoddhṛtasyeṣṭavivarjitasya  
 dalena tulyaṃ hi tad eva kāryam//80//<sup>355</sup>

80

yatra prathamapakṣamūle gṛhīte dvitīyapakṣe varṇayoḥ kṛtī sarūpe arūpe vā bhavatas tatraikāṃ varṇakṛtiṃ prakṛtiṃ prakalpya śeṣaṃ kṣepaḥ/ tata 'iṣṭaṃ hrasvaṃ tasya vargaḥ prakṛtyā kṣuṇṇaḥ' (BG 40ab) ityādikaraṇena kṣepajātīyaṃ varṇam ekādihatam hṛtam vā svabuddhyā kaniṣṭhapadam prakalpya jyeṣṭham sādhyam/ atha vargagatā cet prakṛtis tadā 'iṣṭabhakto dvidhā kṣepaḥ' (BG 54a) ityādinā mūle sādhye//80p1//<sup>356</sup>

yatra bhāvitam ca vartate tatra 'sabhāvite varṇakṛtī tu' (BG 80a) ityādinā tadantarvartino yāvato mūlam asti tāvato mūlam grāhyam/ śeṣasyeṣṭoddhṛtasyeṣṭavivarjitasya dalena samaṃ tad eva mūlam kāryam//80p2//<sup>357</sup>

yatra tu dvitryādayo varṇavargādyā bhavanti tatra dvāv iṣṭau varṇau muktvānyeṣām iṣṭāni mānāni kṛtvā mūle sādhye//80p3//

evaṃ tadaiva yadāsakṛt samīkaraṇam/ yadā tu sakṛd eva samīkaraṇam tadaikaṃ varṇam muktvānyeṣām iṣṭāni mānāni kṛtvā prāgvan mūle//80p4//<sup>358</sup>

udāharaṇam/E94p0/

tau rāśī vada yatkrtyoḥ saptāṣṭaguṇayor yutiḥ/  
 mūladā syād viyogas tu mūlado rūpasamṃyutaḥ//E94//<sup>359</sup>

E94

atra rāśī yā 1/ kā 1/ anayor vargayoḥ saptāṣṭaguṇayor yutiḥ yāva 7 kāva 8/ ayaṃ varga iti nīlakavargeṇa samīkaraṇārtham nyāsaḥ/

yāva	7	kāva	8	nīva	0
yāva	0	kāva	0	nīva	1

samaśodhane kṛte

yāva	7	kāva	0	nīva	0
yāva	0	kāva	8	nīva	1

<sup>355</sup>Kṛṣṇa in TP places BG 80 between E95 and E96. ca AMG ] tu TP; iṣṭoddhṛtasyeṣṭa AMTP ] iṣṭoddhṛtasyeṣṭa G.

<sup>356</sup>kṣepaḥ (1st) G ] kṣepam AM; ekādihatam hṛtam vā ] ekādihṛtam yutam vā AM, ekādihatam yutam vā G; prakṛtis tadā ] prakṛtir iti tadā AM, prakṛtiḥ G.

<sup>357</sup>ca AM ] ∅ G; tu AM ] ∅ G; śeṣasyeṣṭoddhṛta AM ] śeṣasyeṣṭoddhṛta G.

<sup>358</sup>tadaikaṃ MG ] tadakaṃ A.

<sup>359</sup>saptāṣṭa MGTP ] saptāṣṭa A.

kālakavargāṣṭakam prakṣipya

yāva	7	kāva	8	nīva	0
yāva	0	kāva	0	nīva	1

grhītam nīlakapakṣasya mūlam nī 1/ parapakṣasyāsyā yāva 7 kāva 8 vargaprakṛtyā mūle/ tatra yāvattāvadvarge yo 'ṅkaḥ sā prakṛtiḥ 7/ śeṣam kṣepaḥ kāva 8/ 'iṣṭam hrasvam' (BG 40a) ityādinā kālakadvayam iṣṭam prakalpya jāte mūle kaniṣṭham kā 2/ jyeṣṭham kā 6/ jyeṣṭham nīlakamānam kaniṣṭham yāvattāvanmānam/ tena yāvattāvad utthāpya jātau rāśi kā 2/ kā 1/ punar etadvargayoḥ saptāṣṭagunayor antaram saikam jātam kāva 20 rū 1/ etad varga iti prāgval labdham kaniṣṭhamūlam 2 vā 36/ etatkālakamānenotthāpitau jātau rāśi 4/ 2/ vā 72/ 36//E94p//<sup>360</sup> udāharaṇam/E95p0/

**ghanavargayutir vargo yayo rāśyoḥ prajāyate/**

E95

**samāso 'pi yayor vargas tau rāśi śighram ānaya//E95//<sup>361</sup>**

atra rāśi yā 1/ kā 1/ anayor vargaghanayor yogah yāva 1 kāgha 1/ ayam varga iti nīlakavargasamaṃ kṛtvā pakṣayoḥ kālakaghanam prakṣipya nīlakapakṣasya mūlam nī 1/ parapakṣasyāsyā yāva 1 kāgha 1 vargaprakṛtyā mūle/ tatra yāvattāvadvarge yo 'ṅkaḥ sā prakṛtiḥ śeṣam kṣepaḥ prakalpyaḥ/ prakṛtiḥ 1/ kṣepaḥ kāgha 1/ 'iṣṭabhakto dvidhā kṣepaḥ' (BG 54a) ityādinā kālakeneṣṭhena jāte mūle ka kāva  $\frac{1}{2}$  kā  $\overset{\bullet}{1}$  jye kāva  $\frac{1}{2}$  kā 1 / kaniṣṭham yāvattāvanmānam tenotthāpya jātau rāśi kāva  $\frac{1}{2}$  kā  $\overset{\bullet}{1}$  / kā 1/ anayoḥ samāsaḥ kāva  $\frac{1}{2}$  kā 1 / ayam varga iti pītakavargeṇa samīkaraṇam kṛtvā pakṣaśeṣam caturbhiḥ saṃguṇya rūpam prakṣipya prathamapakṣamūlam kā 2 rū 1/ parapakṣasyāsyā pīva 8 rū 1 vargaprakṛtyā mūle ka 6/ jye 17/ vā ka 35/ jye 99/ jyeṣṭham pūrvamūlenānena kā 2 rū 1 samaṃ kṛtvā labdham kālakamānam 8 vā 49/ anenotthāpya jātau rāśi 28/ 8/ vā 1176/ 49//E95p1//<sup>362</sup>

athavā rāśi yāva 2/ yāva 7/ anayor yogah yāva 9/ ayam varga eva/ athānayor ghanavargayogah yāvagha 8 yāvava 49/ eṣa varga iti kālakavargeṇa samīkṛtya prāgval yāvattāvadvargavargeṇāpavartya labdham yāvattāvanmānam 2/ 3/ vā 7/

<sup>360</sup>	yāva	7	kāva	0	nīva	0
	yāva	0	kāva	8	nīva	1

] ∅ AMG; yāva 7 kāva 8 nīva 0 (2nd) ] ∅ AMG; nī 1 AG ] nā M; kāva 8 (1st) AM ] kāva  $\overset{\bullet}{8}$  G; prakṛtiḥ 7 G ] prakṛtiḥ AM; kaniṣṭham kā 2 AM ] ka kā 2 G; jyeṣṭham kā 6 AM ] jye kā 6 G; etadvargayoḥ AM ] etayorvargayoḥ G; kālakamānenotthāpitau G ] kālamānenotthāpitau AM.

<sup>361</sup>yayo rāśyoḥ AMGP ] yayoh rāśyoḥ T; samāso AMGP ] samāse T.

<sup>362</sup>prakṛtiḥ 1 ] prakṛtiḥ yāva 1 AMG; saṃguṇya AG ] saṃganya M. Here and hereafter, the step of samaśodhana is often to be understood in the procedure of samīkaraṇa; the existence of that step can be inferred from the phrase, 'pakṣayoḥ kālakaghanam prakṣipya.' Cf. E94p.

anentothāpitau rāśī 8/ 28/ vā 18/ 63/ vā 98/ 343//E95p2//<sup>363</sup>

‘sabhāvite varṇakṛtī tu yatra’ (BG 80a) ityetaadviṣayībhūtam udāharaṇam/  
E96p0//<sup>364</sup>

**yayor vargayutir ghātayutā mūlapradā bhavet/  
tanmūlaguṇīto yogaḥ sarūpaś cāśu tau vada//E96//<sup>365</sup>**

E96

atra rāśī yā 1/ kā 1/ anayor ‘vargayutir ghātayutā’ yāva 1 yākābhā 1 kāva 1/ asyā  
mūlam nāstīti nīlakavargeṇa samām etām kṛtvā pakṣayoḥ kālakavargaṃ prakṣipya  
pakṣau ṣaṭtrimśatā saṃguṇya labdham nīlakapakṣamūlam nī 6/ parapakṣasyāsya  
yāva 36 yākābhā 36 kāva 36 yāvato mūlam asti tāvataḥ ‘sabhāvite varṇakṛtī tu’  
(BG 80a) ityādinā mūlam gr̥hītam yā 6 kā 3/ śeṣasyāsya kāva 27 iṣṭena kālakena  
1 hr̥tasyeṣṭakālakavarjitasya ca dalena kā 13 tanmūlasamaṃ kṛtvā labdham yāvat-  
tāvanmānam kā  $\frac{5}{3}$  / anena yāvattāvad utthāpya jātau rāśī kā  $\frac{5}{3}$  / kā 1/ anayor  
vargayuteḥ kāva  $\frac{34}{9}$  ghātayutāyāḥ  $\frac{49}{9}$  mūlam kā  $\frac{7}{3}$  / anena rāśiyogo kā  $\frac{8}{3}$   
guṇitaḥ kāva  $\frac{56}{9}$  sarūpo jātaḥ kāva  $\frac{56}{9}$  rū 9 / amuṃ pītakavargasamaṃ kṛtvā  
samachedīkṛtya pakṣayor nava rūpāni prakṣipya labdham kaniṣṭhamūlam 6 vā  
180/ etat kālakamānam ity anentothāpitau jātau rāśī 10/ 6/ vā 300/ 180/ evam  
anekadhā//E96p//<sup>366</sup>

atha kasyāpy udāharaṇam/E97p0/

**yat syāt sālpadhārdhato ghanapadaṃ yad vargayogāt padaṃ  
yad yogāntarayor dvikābhyadhikayor vargāntarāt sāṣṭakāt/  
yac caitatpadapañcakaṃ ca militaṃ syād vargamūlapradaṃ  
tau rāśī kathayāśu nīscalamate ṣaṭkāṣṭakābhyām vinā//E97//<sup>367</sup>**

E97

sālpadhasyārdhād ghanapadaṃ grāhyam/ atrālāpānām bahutve ‘sākṛtkriyā

<sup>363</sup>ayam varga eva AM ] svayam varga eva G; ghanavargayogaḥ AM ] ghanavargayoryogaḥ G; yāvat-  
tāvadvargavargenāpavartya ] yāvattāvadvargenāpavarttya AMG; 2/ 3/ vā 7/ AM ] 2/ vā 7 G; 8/  
28/ vā 18/ 63/ vā 98/ 343 ] 8/ 28/ 18/ 63/ vā 98/ 343 AM, 28/ 8/ vā 98/ 343/ vā 18/ 63/ vā 128/  
448 G.

<sup>364</sup>yatra ityetaad AM ] yatra etad G.

<sup>365</sup>vargayutir AMGP ] vargayuti T.

<sup>366</sup>nīlakavargeṇa samām etām kṛtvā AM ] nīlakavargasamaṃ kṛtvā G; pakṣayoḥ (1st) AM ] ∅ G;  
yākābhā AM ] yā.kābhā G; tu AM ] ∅ G; yā 6 kā 3 AM ] yā 6 kā 6 G; tanmūlasamaṃ G ] tanmūlam  
samaṃ AM;  $\frac{34}{9}$  G ]  $\frac{34}{3}$  AM; kā  $\frac{7}{3}$  AM ] ka  $\frac{7}{3}$  G; kāva  $\frac{56}{9}$  rū 9 ]  $\frac{kā\ 56\ rū\ 9}{9}$  AM, kāva  
 $\frac{56}{9}$  rū 9 G; jātau (2nd) MG ] ∅ A.

<sup>367</sup>sālpa AMTP ] sālya G; yad yogāntarayor AMG ] ye yogāntarayor TP; yac caitat AMTP ] taccaitat  
G; pañcakaṃ ca TP ] pañcakaṃ tu AMG.

kāryā/ sā na nirvahati/ ato buddhimatā tathā rāśī kalpyau yathaikenaiva varṇena sarve 'py ālāpā ghaṭante//E97p1//<sup>368</sup>

tathā kalpitau rāśī yāva 1 rū 1̇/ yā 2/ anayoḥ sālpadhārdhato ghanapadam yā 1/ vargayogāt padam yāva 1 rū 1/ dvyadhikayogapadam yā 1 rū 1/ dvyadhikāntarapadam yā 1 rū 1̇/ sāṣṭavargāntarapadam yāva 1 rū 3/ eṣāṃ yogaḥ yāva 2 yā 3 rū 2/ ayaṃ varga iti kālakavargasamaṃ kṛtvā pakṣāv aṣṭabhiḥ saṃguṇya pañcaviṃsati-rūpāṇi prakṣipyā prathamapakṣasya mūlam yā 4 rū 3/ parapakṣasyāsyā kāva 8 rū 25 vargaprakṛtyā mūle ka 5 jye 15/ vā ka 30 jye 85/ vā ka 175 jye 495/ jyeṣṭham pūrva-padena samaṃ kṛtvā labdham yāvattāvanmānam 3 vā  $\frac{41}{2}$  vā 123/ anenothāpitau rāśī 8/ 6/ vā  $\frac{1677}{4}$  / 41/ vā 15128/ 246/ evam anekadhā//E97p2//<sup>369</sup>

athavā yāvattāvadvargo yāvattāvaddvayena yuta eko rāśiḥ yāva 1 yā 2/ yāvattāvaddvayaṃ rūpadvayayutam anyarāśiḥ yā 2 rū 2/ athavā yāvattāvadvargo yāvattāvaddvayona eko rāśiḥ yāva 1 yā 2/ yāvattāvaddvayaṃ rūpadvayonam anyarāśiḥ yā 2 rū 2/ athavā yāvattāvadvargo yāvattāvaccatuṣṭayaṃ rūpatrayayutam caiko rāśiḥ yāva 1 yā 4 rū 3/ yāvattāvaddvayaṃ rūpacatuṣṭayaṃ cānyaḥ yā 2 rū 4//E97p3//<sup>370</sup>

**evaṃ sahasradhā gūḍhā mūḍhānām kalpanā yataḥ/** 81  
**kṛpayā kalpanopāyas tadartham atra kathyate//81//<sup>371</sup>**

atha sūtram vṛttadvayam/82p0/<sup>372</sup>

**sarūpam avyaktam arūpakam vā** 82  
**viyogamūlam prathamam prakalpyam/**  
**yogāntarakṣepakabhajitād yad**  
**vargāntarakṣepakataḥ padam syāt//82//<sup>373</sup>**  
**tenādhikam tat tu viyogamūlam** 83  
**syād yogamūlam tu tayos tu vargau/**

<sup>368</sup>sālpa AM ] sālya G.

<sup>369</sup>sālpa AM ] sālya G; vargāntarapadam MG ] vargāntarapadam A; aṣṭabhiḥ AM ] aṣṭābhiḥ G; 8/ 6 AM ] 6/ 8 G.

<sup>370</sup>yāva 1 yā 2/ yāvattāvaddvayaṃ rūpadvayayutam anyarāśiḥ yā 2 rū 2 A ] yāva 1 yā 2/ yāvattāvaddvayaṃ rūpadvayayutamanyarāśiḥ yā 2 rū 2 M, yāvattāvaddvayaṃ (ṛṇa)rūpadvayayutamanyarāśiḥ yāva 1 yā 2/ yā 2 rū 2 G; athavā yāvattāvadvargo yāvattāvaddvayona ... yā 2 rū 2/ AM ] ∅ G; yāvattāvaccatuṣṭayaṃ MG ] yāvattāvaccatuṣṭayaṃ A; yāva 1 yā 4 rū 3/ yāvattāvadvayam ... yā 2 rū 4 AM ] yāvattāvaddvayaṃ rūpacatuṣṭayaṃ cānyaḥ yāva 1 yā 4 rū 3/ yā 2 rū 4 G.

<sup>371</sup>kṛpayā AM ] kriyayā GTP; tadartham atra T ] tadarthamatha GP, teṣāmeva ca AM.

<sup>372</sup>atha sūtram vṛttadvayam AM ] sūtram G.

<sup>373</sup>prakalpyam TP ] prakalpya AMG.

svakṣepakonau hi viyogayogau  
syātām tataḥ saṃkramaṇena rāśī//83//

udāharaṇam/E98p0/

rāśyor yogaviyogakau trisahitau vargau bhavetām tayor  
vargaikyam caturūnitam raviyutam vargāntaram syāt kṛtiḥ/  
sālpam ghātadalam ghaṇaḥ padayutis teṣām dviyuktā kṛtis  
tau rāśī vada komalāmalamate ṣaṭ sapta hitvā parau//E98//<sup>374</sup>

E98

atra rūponam avyaktam viyogamūlam prakalpya yā 1 rū 1/ atrāpy anayaiva  
yuktyā kalpitau rāśī yāva 1 rū 2/ yā 2/ vā kalpitau rāśī yāva 1 yā 2 rū 1/ yā 2  
rū 2/ rāśyor yogas trisahitaḥ yāva 1 yā 2 rū 1/ rāśyor antaram trisahitam yāva 1 yā  
2 rū 1/ prathamarāśivargaḥ yāvava 1 yāva 4 rū 4/ dviṭiyarāśivargaḥ yāva 4/ anayor  
aikyam caturūnam yāvava 1/ tayor evāntaram raviyutam yāvava 1 yāva 8 rū 16/  
rāśighātaḥ yāgha 2 yā 4/ dalam yāgha 1 yā 2/ sālpam yāgha 1/ ebhyo mūlāni/ tatra  
triyutayogamūlam yā 1 rū 1/ triyutaviyogamūlam yā 1 rū 1/ caturūnitavargaikyamūlam  
yāva 1/ raviyutavargāntaramūlam yāva 1 rū 4/ tathā ghanamūlam yā 1/  
padapañcakayogo dviyuto jātaḥ yāva 2 yā 3 rū 2/ eṣa varga iti kālakavargeṇa samī-  
karaṇāya nyāsaḥ

yāva	2	yā	3	kāva	0	rū	2
yāva	0	yā	0	kāva	1	rū	0

samīkaraṇāt pakṣaśeṣau

yāva	2	yā	3
kāva	1	rū	2

atraitāv aṣṭabhiḥ saṃguṇya nava rūpāṇi prakṣipyādyapakṣasya mūlam yā 4 rū 3/  
parapakṣasyāsyā kāva 8 rū 25 vargaprakṛtyā mūle ka 5 jye 15/ vā ka 175 jye  
495/ jyeṣṭham prathamapakṣamūlasamaṃ kṛtvāptaṃ yāvattāvanmānam 3/ vā 123/  
vargeṇādyam kevalenāntyam utthāpya jātau rāśī 7/ 6/ vā 15127/ 246//E98p1//<sup>375</sup>

athavā kalpitadvitīyarāśyor yogas triyutaḥ yāva 1 yā 4 rū 4/ viyogas triyutaḥ  
yāva 1/ atrādyavargaḥ yāvava 1 yāgha 4 yāva 2 yā 4 rū 1/ dviṭiyarāśivargaḥ yāva 4  
yā 8 rū 4/ anayor aikyam caturūnam yāvava 1 yāgha 4 yāva 6 yā 4 rū 1/ vargāntaram  
raviyutam yāvava 1 yāgha 4 yāva 2 yā 12 rū 9/ rāśighātaḥ yāgha 2 yāva 6 yā 2 rū 2/

<sup>374</sup>yoga AMGP ] yauga T; sālpam AMTP ] sālyam G; hitvā parau GTP ] hitvāparau AM.

<sup>375</sup>anayaiva G ] ananayaiva AM; kalpitau (1st) MG ] kaspitau A; sālpam AM ] sālyam G; triyuta-  
viyogamūlam yā 1 rū 1/ caturūnitavargaikyamūlam yāva 1/ AM ] ∅ G; samīkaraṇāya AG ] samī-  
karaṇāya M; 

yāva	2	yā	3
kāva	1	rū	2

 G ] yāva 2 yā 3, kāva 1 rū 2 AM; kāva 8 rū 25 vargaprakṛtyā  
AM ] kāva 4 rū 25 vargakṛtyā G.

dalam yāgha 1 yāva 3 yā 1 rū 1̇/ sālpam yāgha 1 yāva 3 yā 3 rū 1/ ebhyo mūlāni/  
tatra triyutayogamūlam yā 1 rū 2/ triyutaviyogamūlam yā 1/ caturūnitavargaikya-  
mūlam yāva 1 yā 2 rū 1/ raviyutavargāntaramūlam yāva 1 yā 2 rū 3̇/ ghanamūlam  
yā 1 rū 1/ padapañcakayogo dviyuktaḥ yāva 2 yā 7 rū 3/ eṣa varga iti kālakavargeṇa  
samīkaraṇāya nyāsaḥ

$$\begin{array}{|c|c|c|c|c|c|} \hline \text{yāva} & 2 & \text{yā} & 7 & \text{kāva} & 0 & \text{rū} & 3 \\ \hline \text{yāva} & 0 & \text{yā} & 0 & \text{kāva} & 1 & \text{rū} & 0 \\ \hline \end{array}$$

samaśodhanāt pakṣaśeṣau

$$\begin{array}{|c|c|c|c|} \hline \text{yāva} & 2 & \text{yā} & 7 \\ \hline \text{kāva} & 1 & \text{rū} & 3̇ \\ \hline \end{array}$$

atra pakṣāv aṣṭabhiḥ saṅguṇyaikonapañcāsād rūpāṇi prakṣipyādyapakṣamūlam yā  
4 rū 7/ parapakṣasyāsyā kāva 8 rū 25 vargaprakṛtyā mūle ka 5 jye 15/ vā ka 175 jye  
495/ jyestham prathamapakṣapadena samaṃ vidhāya labdham yāvattāvanmānam  
2/ vā 122/ atra vargeṇāvyaktavargarāśim kevalenāvyaktam utthāpya jātau rāśi 7/  
6/ vā 15127/ 246//E98p2//<sup>376</sup>

tad yathā/ yā 2/ asya vargaḥ 4/ anena yāva 1 guṇitaḥ 4/ kevalena 2 yā 2 guṇitaḥ  
4/ ubhayor vyaktatvād yogah 8/ ṛṇage rūpe 1̇ viyojite jāta ekaḥ 7/ tathā yā 2  
kevalena yā 2 guṇitaḥ 4/ rūpa 2 yuto jātaḥ paraḥ 6/ evaṃ dvitīyaḥ yā 122/ vargaḥ  
14884/ anena yāva 1 guṇitaḥ 14884/ kevalena yā 122 yā 2 guṇitaḥ 244/ ubhayor  
vyaktayor yogād ṛṇam rūpaṃ viśodhya jāta ekaḥ 15127/ tathā yā 2 kevalena 122  
guṇito vyaktarūpa 2 yuto `paraḥ 246/ evaṃ bahudhā//E98p3//<sup>377</sup>

ādyodāharaṇam/E99p0/

**rāśyor yayoh kṛtiyutiviyutī caikena samyute vargau/  
rahite vā tau rāśi gaṇayitvā kathaya yadi vetsi//E99//<sup>378</sup>**

E99

atra prathamodāharaṇe kalpitau rāśivargau yāva 4/ yāva 5 rū 1̇/ anayor yoga-  
viyogau rūpayutau mūladau bhavataḥ/ kathitaprathamavargasya mūlam eko rāśiḥ  
yā 2/ dvitīyasyāsyā yāva 5 rū 1̇ vargaprakṛtyā mūle ka 1 jye 2/ vā ka 17 jye 38/

<sup>376</sup>dvitīyarāśivargah MG ] dvitīyarāśivargah A; yāva 4 yā 8 rū 4 G ] yāva 4 yā 8 rū 4 AM;  
sālpam AM ] sālyam G; eṣa varga MG ] varga A;  $\begin{array}{|c|c|c|c|c|c|} \hline \text{yāva} & 2 & \text{yā} & 7 & \text{kāva} & 0 & \text{rū} & 3 \\ \hline \text{yāva} & 0 & \text{yā} & 0 & \text{kāva} & 1 & \text{rū} & 0 \\ \hline \end{array}$  AM

]  $\begin{array}{|c|c|c|c|c|c|} \hline \text{yā} & 2 & \text{yā} & 7 & \text{kāva} & 0 & \text{rū} & 3 \\ \hline \text{yā} & 0 & \text{yā} & 0 & \text{kāva} & 1 & \text{rū} & 0 \\ \hline \end{array}$  G;  $\begin{array}{|c|c|c|c|} \hline \text{yāva} & 2 & \text{yā} & 7 \\ \hline \text{kāva} & 1 & \text{rū} & 3̇ \\ \hline \end{array}$  ] yāva 2 yā 7, kāva 1 rū 3̇ AM,  
ya 2 yā 7  
kāva 1 rū 3̇ G.

<sup>377</sup>anena yāva 1 (1st) AM ] anena yā 1 G; kevalena yā 122 MG ] kevalena 122 A; viśodhya MG ]  
viśodhyam A; rūpa 2 yuto AG ] rūpa 3 yuto M.

<sup>378</sup>kṛtiyutiviyutī AMGT ] kṛtiyutī P; samyute AMGT ] samyutau P; rahite AMGT ] rahitau P.

anayor jyeṣṭhapadaṃ dvitīyarāśiḥ/ hrasvaṃ yāvattāvanmānam/ anenothāpyādya-rāśiḥ/ evaṃ jātau rāśi 2/ 2/ vā 34/ 38//E99p1//<sup>379</sup>

atha dvitīyodāharaṇe tathaiva kalpitaḥ prathamarāśiḥ yā 2/ dvitīyasyāsya yāva 5 rū 1 vargaprakṛtyā mūle ka 4 jye 9/ vā ka 72 jye 161/ kaniṣṭhena prathama utthāpito jyeṣṭhaṃ dvitīya iti jātau rāśi 8/ 9/ vā 144/ 161//E99p2//<sup>380</sup>

atrāparāśivargeṇa yo rāśir ūnito yutaś ca mūladaḥ syāt sa tāvad vyakta eva dvitīyo jñeyah/ tasyānayane 'py upāyas tad yathā/ kalpitarāśivargaḥ 4/ anena dvitīyarāśir ūnito yutaś ca mūladaḥ syād ity ayam dviguṇaḥ 8/ vargāntaram idaṃ kayor api ca yogāntaraghātasamam/ ato 'ntaram iṣṭaṃ 2 kalpitam/ 'vargāntaram rāśiviyogabhaktam' (L 58) iti jāte vargāntarayogamūle 1/ 3/ ādyasya varge 1 kalpitarāśivargaṃ 4 prakṣipya dvitīyasya vargāt 9 vā viśodhya jāto dvitīyaḥ 5/ atra cālparāśivargas tathā kalpyate yathā dvitīyarāśir abhinnaḥ syāt//E99p3//

tathānyaḥ kalpitaḥ 36/ dviguṇaḥ 72/ idaṃ vargāntaram/ rāśyantaraṣaṭke kalpite jātau 3/ 9/ anyavargāt 81 kalpitam 36 viśodhya jāto dvitīyaḥ 45/ catuṣkeṇa vā 85/ dvikena vā 325//E99p4//<sup>381</sup>

athānyathā kalpane yuktiḥ/ rāśyor ghātena dviguṇena vargayogo yutonito 'vaśyaṃ mūladaḥ syāt/ rāśivadho dviguṇo yathā vargaḥ syāt tathaiko vargo 'nyo vargārdham iti kalpyau/ yato vargayor vadho vargo bhavatīti tathā kalpitau/ eko vargaḥ 1/ anyo vargārdham 2/ anayor ghāto 2 dviguṇaḥ 4/ ayam prathamah/ ayam alparāśivargaḥ/ tayor eva vargayogaḥ 5/ ayam dvitīyo rāśiḥ/ athavaiko vargaḥ 9/ anyo vargārdham 2/ anayor ghāto 18 dviguṇaḥ 36/ ayam alparāśivargaḥ/ atha tayor eva vargayogaḥ 85/ ayam dvitīyo rāśiḥ/ etau vyaktau yāvattāvadvargaguṇau kalpitau/ prathamodāharaṇe dvitīyo rāśi rūpeṇono dvitīyodāharaṇe rūpayutaḥ kāryaḥ/ evaṃ kṛtvā tau tathā rāśivargau kalpyau yathālāpadvayaṃ ghaṭate kimtu prathamasya mūlaṃ grhītvā dvitīyasya vargaprakṛtyā mūlam ityādi pūrvoktam eva/ evam anekadhā//E99p5//<sup>382</sup>

sūtram/84p0/<sup>383</sup>

**yatrāvyaktaṃ sarūpaṃ hi tatra tanmānam ānayet/**

84

**sarūpasyānyavarṇasya kṛtvā kṛtyādinā samam//84//**

**rāśiṃ tena samutthāpya kuryād bhūyo 'parāṃ kriyām/**

85

**sarūpeṇānyavarṇena kṛtvā pūrvapadaṃ samam//85//**

<sup>379</sup>atra prathamodāharaṇe ] atha prathamodāharaṇe AM, atra G; yāva 5 rū 1 G ] yāva 5 rū 1 AM; mānam/ anenothāpyādya ] mānenothāpyādya MG, mānenothāpyādya A.

<sup>380</sup>kaniṣṭhena MG ] kaniṣṭhena A.

<sup>381</sup>36 (2nd) G ] ∅ AM.

<sup>382</sup>vargaguṇau AM ] vargaguṇitau G; prathamodāharaṇe dvitīyo rāśi rūpeṇono dvitīyodāharaṇe rūpayutaḥ kāryaḥ G ] prathamodāharaṇe rūpayutaḥ dvitīyo rāśi rūpeṇono dvitīyodāharaṇe kāryaḥ AM; tau tathā AM ] tathā tau G; kalpyau (last) G ] kalpitau AM.

<sup>383</sup>sūtram G ] ∅ AM.

yatrādyapakṣamūle gṛhīte parapakṣe 'vyaktaṃ sarūpaṃ arūpaṃ vā syāt tatrānyavarṇasya sarūpasya vargeṇa sāmyaṃ kṛtvā tasyāvvyaktasya mānam ānīya tena rāśim utthāpya punar anyāṃ kriyāṃ kuryāt/ tathā tenānyavarṇena sarūpeṇādyapakṣapadasāmyāc ca/ yadi punaḥ kriyā na bhavet tadā tu vyaktenaiva vargādinā samakriyā//85p//<sup>384</sup>

udāharaṇam/E100p0/

**yas tripañcagaṇo rāśiḥ pṛthak saikaḥ kṛtir bhavet/**

E100

**vada taṃ bījamadhye 'si madhyamāharaṇe paṭuḥ//E100//<sup>385</sup>**

atra rāśiḥ yā 1/ eṣa triguṇaḥ saikaḥ yā 3 rū 1/ ayaṃ varga iti kālakavargasamaṃ kṛtvā pakṣayo rūpaṃ prakṣipyā labdhaṃ kālakapakṣasya mūlam kā 1/ anyapakṣasyāsyā yā 3 rū 1 sarūpanīlakatrayasya vargeṇa nīva 9 nī 6 rū 1 sāmyaṃ kṛtvā labdhayāvattāvanmānenotthāpito jāto rāśiḥ nīva 3 nī 2/ punar ayaṃ pañcagaṇaḥ saiko varga iti nīva 15 nī 10 rū 1 pītakavargasamaṃ kṛtvā samaśodhane kṛte pakṣau

nīva	15	nī	10
pīva	1	rū	1

imau pañcadaśabhiḥ saṃguṇya pañcaviṃśatirūpāṇi prakṣipyādyapakṣasya mūlam nī 15 rū 5/ parapakṣasyāsyā pīva 15 rū 10 vargaprakṛtyā mūle ka 9 jye 35/ vā ka 71 jye 275/ kaniṣṭhaṃ pītakamānam/ jyeṣṭhaṃ ādyapakṣasya mūlenānena nī 15 rū 5 samaṃ kṛtvāptaṃ nīlakamānam 2 vā 18/ svasvamānenotthāpya jāto rāśiḥ 16 vā 1008//E100p1//<sup>386</sup>

athavaikālāpaḥ svata eva saṃbhavati tathā kalpito rāśiḥ yāva  $\frac{1}{3}$  rū  $\frac{1}{3}$  / eṣa pañcagaṇo rūpayutaḥ yāva  $\frac{5}{3}$  rū  $\frac{2}{3}$  mūlada iti kālakavargasamaṃ kṛtvā pakṣayor ṛnatryaṃśadvayaṃ prakṣipyoktavad gṛhītaṃ kālakapakṣasya mūlam kā 1/ dvitīyapakṣasyāsyā yāva  $\frac{5}{3}$  rū  $\frac{2}{3}$  vargaprakṛtyā mūle ka 7 jye 9/ vā ka 55 jye 71/ atra kaniṣṭhaṃ prakṛtivarṇamānam/ tena kalpitarāśim utthāpya jāto rāśiḥ sa eva 16/ vā 1008//E100p2//<sup>387</sup>

<sup>384</sup>padasāmyāc ca AM ] padasāmyaṃ ca G.

<sup>385</sup>vada taṃ GTP ] vadeti AM.

<sup>386</sup>pakṣayo rūpaṃ G ] pakṣayoh rūpaṃ 1 AM; labdhaṃ kālakapakṣasya mūlam kā 1 G ] mūlam kā 1 AM; 

nīva	15	nī	10
pīva	1	rū	1

 M ] nīva 15 nī 10/ pīva 1 rū 1 AG; saṃguṇya G ] saṃguṇyaḥ A, saṃgaṇya M; prakṣipyādyapakṣasya AM ] prakṣipyādyasya pakṣasya G.

<sup>387</sup>tathā kalpito AM ] tadā kalpito G; yāva  $\frac{1}{3}$  rū  $\frac{1}{3}$  AM ] yāva  $\frac{1}{3}$  rū  $\frac{2}{3}$  G; yāva  $\frac{5}{3}$  rū  $\frac{2}{3}$

(1st) AM ] yāva  $\frac{5}{3}$  rū  $\frac{1}{3}$  G; pakṣayor ṛna G ] pakṣayo ṛna AM; yāva  $\frac{5}{3}$  rū  $\frac{2}{3}$  (2nd) ] yāva  $\frac{5}{3}$

rū  $\frac{2}{3}$  AM,  $\frac{yāva\ 5}{3}$  rū  $\frac{2}{3}$  G.



athādyodāharaṇam/E101p0/

**ko rāsīḥ tribhir abhyastaḥ sarūpo jāyate ghanah/** E101  
**ghanamūlaṃ kṛtibhūtaṃ tryabhyastaṃ kṛtir ekayuk//E101//<sup>388</sup>**

atra rāsīḥ yā 1/ ayam tryabhyasto rūpayutaḥ yā 3 rū 1/ eṣa ghana iti kālaka-  
ghanasamaṃ kṛtvā prāgvaj jāto rāsīḥ kāgha  $\frac{1}{3}$  rū  $\frac{1}{3}$  / asya triguṇasya sarūpasya  
ghanamūlaṃ vargitaṃ trihataṃ rūpayutaṃ kāva 3 rū 1/ etat kṛtir iti nīlaka-  
vargasamaṃ kṛtvā pakṣayo rūpaṃ prakṣipya prathamapakṣamūlam nī 1/ dvitīya-  
pakṣasyāsya kāva 3 rū 1 vargaprakṛtyā mūle ka 1 jye 2/ vā ka 4 jye 7/ vā ka  
15 jye 26/ kaniṣṭhaṃ kālakamānam 4/ asya ghanena 64 utthāpito rāsīḥ 21 vā  
 $\frac{3374}{3}$  //E101p//<sup>389</sup>  
udāharaṇam/E102p0/

**vargāntaraṃ kayo rāśyoḥ pṛthag dvitriguṇaṃ triyuk/** E102  
**vargau syātāṃ vada kṣipraṃ ṣaṭkapañcakayor iva//E102//<sup>390</sup>**

**kvacid ādeḥ kvacin madhyāt kvacid antyāt kriyā budhaiḥ/** 86  
**ārabhyate yathā laghvī nirvahec ca yathā tathā//86//<sup>391</sup>**

ato 'tra vargāntaram yā 1/ etad dvighnaṃ triyutaṃ yā 2 rū 3 varga iti kālaka-  
vargasamaṃ kṛtvāptayāvattāvanmānenotthāpito jāto rāsīḥ kāva  $\frac{1}{2}$  rū  $\frac{3}{2}$  / punar  
idam trighnaṃ triyutaṃ kāva  $\frac{3}{2}$  rū  $\frac{3}{2}$  varga iti nīlakavargasamaṃ kṛtvā sama-  
śodhane kṛte jātau pakṣau

$$\left[ \begin{array}{cc} \text{nīva } 2 & \text{rū } 3 \\ \text{kāva } 3 & \end{array} \right]$$

etau tribhiḥ saṃguṇya kālakapakṣamūlam kā 3/ parapakṣasyāsya nīva 6 rū 9 varga-  
prakṛtyā mūle ka 6 jye 15/ vā ka 60 jye 147/ jyeṣṭhaṃ prathamapakṣapadena kā 3  
samaṃ kṛtvā labdhaṃ kālakamānam 5 vā 49/ prāgvad āptakālakamānenotthāpitaṃ  
jātaṃ vargāntaraṃ rāśyoḥ 11 vā 1199/ idam antarahṛtaṃ dvidhāntareṇonayutaṃ  
ardhitaṃ rāsī bhavata iti prāg uktam (BG E99p4)/<sup>392</sup> ato 'ntaram iṣṭaṃ rūpaṃ  
prakalpya jātau rāsī 6/ 5/ vā 600/ 599/ athavāntaram ekādaśa prakalpya jātau rāsī

<sup>388</sup>sarūpo AMGP ] sarūpe T.

<sup>389</sup>rū  $\frac{1}{3}$  AM ] rū  $\frac{1}{3}$  G.

<sup>390</sup>kayo rāśyoḥ GTP ] kayoḥ rāśyo A, kayoḥ rāśyoḥ M.

<sup>391</sup>laghvī AMGP ] lubdhī T.

<sup>392</sup>Cf. L 56 & 58.

60/ 49//E102p//<sup>393</sup>anyat karaṇasūtram sārdhavṛttam/87p0/<sup>394</sup>

**vargāder yo haras tena guṇitam yadi jāyate/  
avyaktaṃ tatra tanmānam abhinnaṃ syād yathā tathā/  
kalpyo 'nyavarṇavargādis tulyaḥ śeṣaṃ yathoktavat//87//<sup>395</sup>**

87

yatra vargādaḥ kuṭṭakādaḥ vaikapakṣamūle gṛhīte 'nyapakṣe 'vyaktavargādikasya  
yo haras tena guṇitam avyaktaṃ yadi syāt tadā tasya mitir abhinnaḥ yathā syāt  
tathānyavarṇavargādiḥ sarūpo rūpono vā tulyaḥ kalpyaḥ/ śeṣaṃ pūrvasūtroktam  
(BG 84–85)//87p//<sup>396</sup>

udāharaṇam/E103p0/

**ko vargaś caturūnaḥ san saptabhakto viśudhyati/  
triṃśadūno 'thavā kaḥ syād yadi vetsi vada drutam//E103//<sup>397</sup>**

E103

atra rāśiḥ yā 1/ asya vargaś caturūnaḥ saptabhakto viśudhyatīti labdhipramāṇam  
kālakaḥ/ tadguṇitahareṇāsya yāva 1 rū 4 sāmyaṃ kṛtvā prathamapakṣamūlam  
yā 1/ parapakṣasyāsya kā 7 rū 4 mūlābhāvād 'vargāder yo haras tena guṇitam  
yadi jāyate' (BG 87ab) ityādinā karaṇena nīlakaśaptakasya rūpadvayādhikasya  
vargeṇa tulyaṃ kṛtvā labdham kālakamānam abhinnaṃ jātam nīva 7 nī 4/ yat tu  
kalpitaṃ tasya dvitīyapakṣasya mūlam nī 7 rū 2/ idaṃ prākpakṣamūlasyāsya yā 1  
samaṃ kṛtvāptaṃ yāvattāvanmānam nī 7 rū 2/ sakṣepam 9/ asya vargo rāśiḥ syāt  
81//E103p//<sup>398</sup>

athavānyavarṇakalpanāyāṃ mandāvabodhāya pūrvair upāyaḥ paṭhitāḥ/ tatra  
sūtrāṇi/88p0/<sup>399</sup>

**harabhaktā yasya kṛtiḥ śudhyati so 'pi dvirūpapadaguṇitaḥ/  
tenāhato 'nyavarṇo rūpapadenānvitaḥ kalpyaḥ//88//  
na yadi padaṃ rūpānāṃ kṣīped dharaṃ teṣu hārataṣṭeṣu/  
tāvad yāvad vargo bhavati na ced evam api khilaṃ tarhi//89//<sup>400</sup>**

88

89

<sup>393</sup>mūlam kā 3 AM ] mūlam kā 3 kṛtvā G; labdham kālakamānam AM ] labdhakālakamānam G;  
600 AM ] 60 G; ekādaśa MG ] ekādaśaṃ A.

<sup>394</sup>anyat AM ] athānyat G.

<sup>395</sup>tulyaḥ AMGT ] tulyaṃ P.

<sup>396</sup>sūtroktam AM ] sūtravat G.

<sup>397</sup>kaḥ syād AMG ] kastaṃ TP.

<sup>398</sup>kā 7 rū 4 AG ] kā 7 rū 4 M.

<sup>399</sup>tatra sūtrāṇi AM ] sūtram G

<sup>400</sup>yadi AMGP ] yadiha T.

**hatvā kṣiptvā ca padaṃ yatrādyasyeha bhavati tatrāpi/  
ālāpita eva haro rūpāṇi tu śodhanādisiddhāni//90//<sup>401</sup>**

90

harabhakteti/ yasyāṅkasya kṛtir harabhaktā satī śudhyatīti niḥśeṣā bhavati/ api ca so 'py aṅko dvābhyāṃ rūpapadena ca guṇito harabhaktaḥ san śudhyati tadā tenāṅkena hato 'nyavarṇas tena rūpenānvitaḥ kalpyaḥ/ yadi tu rūpāṇāṃ padaṃ na tadā teṣu harataṣṭeṣu rūpeṣu tāvad dharaṃ kṣiped yāvad vargo bhavet/ tanmūlaṃ rūpapadaṃ bhavet/ evam api kṛte ced vargaḥ kadācin na bhavet tadā tadudāharaṇaṃ khilaṃ syāt/ yatra tv ādyapakṣasya mūlaṃ 'hatvā kṣiptvā' (BG 90a) ityādinā labhyate tadā hara ālāpita eva grāhyo na tu guṇito vibhakto vā/ rūpāṇi tu samaśodhane kṛte śodhanādisiddhāni yāni tāny eva grāhyāni//90p1//<sup>402</sup>

evam ghane 'pi yojoyam/ tad yathā/ yasyāṅkasya ghano harabhaktaḥ śudhyati tathā ca so 'py aṅkas tribhī rūpāṇāṃ ghanamūlena ca guṇito harabhaktaḥ śudhyati tadā tenāṅkena hato 'nyavarṇo rūpāṇāṃ ghanamūlena cānvitaḥ kalpyaḥ/ yadi rūpāṇāṃ ghanamūlaṃ na labhyate tadā teṣu rūpeṣu harataṣṭeṣu tāvad dharaṃ kṣiped yāvad ghano bhavet/ tac ca ghanamūlaṃ rūpapadaṃ syāt/ evam api kṛte ca ghaṇaḥ kadācin na bhavet tadudāharaṇaṃ khilaṃ syād ity agre 'pi yojoyam iti śeṣaḥ//90p2//

atha dvitīyodāharaṇe (BG E103) rāśiḥ yā 1/ asya yathoktaṃ kṛtvādyapakṣasya mūlaṃ yā 1/ parapakṣasyāsyā kā 7 rū 30 'na yadi padaṃ rūpāṇāṃ' (BG 89a) ityādikaraṇena hārataṣṭarūpeṣu dviguṇaṃ haraṃ prakṣipyā mūlaṃ 4/ etadadhika- nīlakasaptakavargasamīkaraṇādinā prāgvaj jāto rāśiḥ nī 7 rū 4/ atha yady ṛṇa- rūpair anvitaṃ nīlakasaptakaṃ nī 7 rū 4 parikalpyānyate tadānyo 'pi rāśiḥ 3 syāt//90p3//<sup>403</sup>

udāharaṇam/E104p0/<sup>404</sup>

**ṣaḍbhir ūno ghaṇaḥ kasya pañcabhakto viśudhyati/  
taṃ vadāśu tavālaṃ ced abhyāso ghanakuṭṭake//E104//<sup>405</sup>**

E104

atra rāśiḥ yā 1/ asya yathoktaṃ kṛtvādyapakṣasya ghanamūlaṃ yā 1/ parapakṣasyāsyā kā 5 rū 6 'harabhakto yasya ghaṇaḥ śudhyati so 'pi trirūpapada- guṇitaḥ' (≈ BG 88ab)<sup>406</sup> ityādiyuktyā nīlakapañcakasya rūpaṣaṭkādihikasya ghanena sāmīyaṃ kṛtvā prāgvaj jāto rāśiḥ sakṣepaḥ nī 5 rū 6/ utthāpane kṛte jāto rāśiḥ 6 vā

<sup>401</sup>hatvā TP ] hitvā AMG.

<sup>402</sup>śudhyatīti (1st) AM ] śudhyati G; ca (2nd) AM ] ∅ G; hatvā ] hitvā AMG.

<sup>403</sup>nī 7 rū 4 AG ] nī 7 rū 4 M.

<sup>404</sup>udāharaṇam MG ] ∅ A.

<sup>405</sup>vadāśu AMG ] vadāsti TP.

<sup>406</sup>BG 88, which is meant for square, is here slightly modified for cube.

11//E104p//<sup>407</sup>

udāharaṇam/E105p0/

**yadvargaḥ pañcabhiḥ kṣuṇṇas triyuktaḥ ṣoḍaśoddhṛtaḥ/  
śuddhim eti tam ācakṣva dakṣo 'si gaṇite yadi//E105//<sup>408</sup>**

E105

atra rāśiḥ yā 1/ asya yathoktaṃ kṛtvādyapakṣamūlam yā 5/ parapakṣasyāsyā  
kā 80 rū 15 'hatvā kṣiptvā ca padaṃ yatra' (BG 90ab) ityādināpy atra 'ālāpita  
eva haraḥ' (BG 90c) sthāpyaḥ/ 'rūpāni tu śodhanādisiddhāni' (BG 90d) iti tathā  
kṛte jātam kā 16 rū 15/ amuṃ nīlakāṣṭakasya saikasya vargeṇa samaṃ kṛtvāptaṃ  
kālakamānam abhinnaṃ nīva 4 nī 1 rū 1/ kalpitapadam nī 8 rū 1/ idam ādyasyāsyā  
yā 5 samaṃ kṛtvā kuṭṭakāl labdham yāvattāvanmānam pī 8 rū 5/ utthāpīte jāto  
rāśiḥ 13//E105p1//<sup>409</sup>

athavarṇarūpeṇādihike nīlakāṣṭake kalpīte sati labdham yāvattāvanmānam pī 8  
rū 3//E105p2//<sup>410</sup>

evaṃ 'vargaprakṛtyā viṣayo yathā syāt tathā sudhībhīr bahudhā vicintyam' (BG  
72cd) ity asya prapañco bahudhā darśitaḥ/ tathā vargakūṭṭake 'pi kiṃcid darśitam/  
evaṃ buddhimadbhir anyad api yathāsaṃbhavaṃ yojyam//E105p3//

iti bhāskarīye bījagaṇite 'nekavarṇasaṃbandhimadhyamāharaṇabhedāḥ//E105p4  
//<sup>411</sup>

## II.11 Bhāvita

atha bhāvitam//91p1//<sup>412</sup>

tatra sūtraṃ vṛttam/91p0/

**muktveṣṭavarṇam sudhiyā pareṣām  
kalpyāni mānāni tathepsitāni/  
yathā bhaved bhāvitabhaṅga evaṃ  
syād ādyabījakriyayeṣṭasiddhiḥ//91//<sup>413</sup>**

91

yatrodāharaṇe varṇayor varṇānām vā vadhād bhāvitam utpadyate tatreṣṭam  
varṇam apahāya śeṣayoḥ śeṣānām vā varṇānām iṣṭāni vyaktāni mānāni kṛtvā tais tān

<sup>407</sup>kā 5 AM ] kāgha 5 G; sakṣepaḥ MG ] samkṣepaḥ A.

<sup>408</sup>ṣoḍaśoddhṛtaḥ AMGP ] ṣoḍaśoddhataḥ T; tam ācakṣva AMG ] samācakṣva TP.

<sup>409</sup>hatvā ] hitvā AMG; kṣiptvā G ] kṣiptā AM.

<sup>410</sup>nīlakāṣṭake AM ] nīlāṣṭake G.

<sup>411</sup>bhāskarīye ] śrīśiddhāntaśiromaṇau bhāskarācāryaviracite AM, śrībhāskarīye G.

<sup>412</sup>atha bhāvitam TG ] atha bhāvitamucyate AM, bhāvitam P.

<sup>413</sup>tathepsitāni/ yathā G ] yathepsitāni/ tathā AMTP.

varṇān pakṣayor utthāpya rūpeṣu prakṣipyaivaṃ bhāvitabhaṅgaṃ kṛtvā prathamabijakriyā varṇamānam ānayet//91p//<sup>414</sup>

udāharaṇam/E106p0/

**catustriguṇayo rāśyoḥ saṃyutir dviyutā tayoh/**

**rāśighātena tulyā syāt tau rāśi vetsi ced vada//E106//<sup>415</sup>**

E106

atra rāśi yā 1 kā 1/ anayor yathokte kṛte jātau pakṣau

yā	4	kā	3	rū	2
		yākābhā	1		

evam bhāvite jāte ‘muktveṣṭavarṇam’ (BG 91a) ityādisūtrena kālakasya kileṣṭam rūpapañcakaṃ mānaṃ kalpitam/ tena prathamapakṣe kālakaṃ utthāpya rūpeṣu prakṣipya jātam yā 4 rū 17/ dviṭiyapakṣe yā 5/ anayoh samaśodhane kṛte prāgval labdham yāvattāvanmānam 17/ evam etau jātau rāśi 17/ 5/ athavā ṣaṭkena kālakaṃ utthāpya jātau rāśi 10/ 6/ evam iṣṭavaśād ānantyam//E106p//<sup>416</sup>

udāharaṇam/E107p0/

**catvāro rāśayaḥ ke te yadyogo nakhasaṃguṇaḥ/**

**sarvarāśihates tulyo bhāvitajña nigadyatām//E107//<sup>417</sup>**

E107

atra rāśiḥ yā 1 śeṣā drṣṭāḥ 5/ 4/ 2/ ataḥ prathamabījena labdham yāvattāvanmānam 11/ evam jātā rāśayaḥ 11/ 5/ 4/ 2/ vā 28/ 10/ 3/ 1/ vā 55/ 6/ 4/ 1/ vā 60/ 8/ 3/ 1/ evam bahudhā//E107p//

udāharaṇam/E108p0/

**yau rāśi kila yā ca rāśinihatir yau rāśivargau tathā**

**teṣām aikyapadaṃ sarāśiyugalaṃ jātā trayoviṃśatiḥ/**

**pañcāśat triyutāthavā vada kiyat tad rāśiyugmaṃ pṛthak**

**tac cābhinnam avehi vatsa gaṇakaḥ kas tvatsamo ’sti kṣitau//**

**E108//<sup>418</sup>**

E108

atra rāśi yā 1/ rū 2/ anayor ghātayutivargāṇāṃ yogah yāva 1 yā 3 rū 6/ imaṃ rāśiyogonatravoviṃśateḥ yā 1 rū 21 vargasyāsyā yāva 1 yā 42 rū 441 samaṃ kṛtvā

<sup>414</sup>utpadyate AM ] ucyate G; bhāvitabhaṅgaṃ MG ] bhāvitamaṅgaṃ A.

<sup>415</sup>guṇayo AMGP ] guṇyo T; saṃyutir AGTP ] saṃyuti M.

<sup>416</sup>yathokte MG ] yathokta A; 

yā	4	kā	3	rū	2
		yākābhā	1		

 G ] yā 4 kā 3 rū 2 = yā.kā.bhā 1 AM; prakṣipya MG ] prakṣiṣya A; 17/ 5 AM ] 15/ 5 G; 10/ 6 AG ] 10, 7 M.

<sup>417</sup>catvāro AGTP ] catvārā M.

<sup>418</sup>nihatir yau GTP ] nihatiryaṃ A, nihātaryau M; vargau MGTP ] vargaṃ A; jātaṃ AM ] jātam GTP; tac cābhinnam G ] kṛtvābhinnam AMTP; avehi AMGP ] avaihi T; vatsa GTP ] vetsi AM.

labdham yāvattāvanmānam  $\frac{29}{3}$  / evam etau rāśī  $\frac{29}{3}$  / 2/ athavā rāśī yā 1/ rū 3/  
ataḥ prāgvaj jātau rāśī  $\frac{97}{11}$  / 3/ evaṃ pañcakam iṣṭaṃ prakalpya jātāv abhinnau  
7/ 5//E108p1//<sup>419</sup>

atha dvitīyodāharaṇe rāśī yā 1/ rū 2/ anayor ghātayutivargāṇām yogāḥ yāva 1  
yā 3 rū 6/ amuṃ rāśīdvayonatripañcāsadvargasyāsyā yāva 1 yā 102 rū 2601 samaṃ  
kṛtvā prāgvaj jātau rāśī  $\frac{173}{7}$  / 2/ vā 11/ 17/ evam ekasmin vyakte rāśau kalpīte  
sati bahunāyāsenābhinnau rāśī jñāyete//E108p2//<sup>420</sup>

atha tau yathālpāyāsena bhavatas tathocyate/ tatra sūtraṃ sārḍhavr̥tta-  
dvayam/92p0/

**bhāvitam pakṣato 'bhīṣṭāt tyaktvā varṇau sarūpakau/** 92  
**anyato bhāvitāṅkena tataḥ pakṣau vibhajya ca/**  
**varṇāṅkāhatirūpaikyam bhaktveṣṭeneṣṭataphale//92//<sup>421</sup>**  
**etābhyām saṃyutāv ūnau kartavyau svecchayā ca tau/** 93  
**varṇāṅkau varṇayor māne jñātavye te viparyayāt//93//<sup>422</sup>**

samayoḥ pakṣayor ekasmād bhāvitam apāsyānyato varṇau rūpāni ca/ tato  
bhāvitāṅkena pakṣāv apavartya dvitīyapakṣe varṇāṅkayor ghātaṃ rūpayutaṃ kena-  
cid iṣṭena vibhajya tadiṣṭaṃ tatphalaṃ ca dve api varṇāṅkābhyām svecchayā yukte  
satī varṇayor māne viparyayena jñātavye/ yatra kālakāṅko yojitas tad yāvattāvan-  
mānam/ yatra yāvattāvadaṅkas tat kālakamānam ity arthaḥ/ yatra tv iyattāvāsād  
evaṃ kṛte saty ālāpo na ghaṭate tatrestaphalābhyām varṇāṅkāv ūnītau vyatyayān  
māne bhavataḥ//93p1//<sup>423</sup>

atha prathamodāharaṇam/Q12p0/

**'catustriguṇayo rāśyoḥ saṃyutir dviyutā tayoh/** Q12  
**rāśighātena tulyā <syāt ...>'//Q12//<sup>424</sup>**

iti/ tatra yathokte kṛte pakṣau

$$\begin{array}{|c|} \hline yā \quad 4 \quad kā \quad 3 \quad rū \quad 2 \\ \hline yākābhā \quad 1 \\ \hline \end{array}$$

'varṇāṅkāhatirūpaikyam' (BG 92e) 14/ etad ekeneṣṭena hṛtaṃ jāte iṣṭaphale 1/ 14/  
ete varṇāṅkābhyām 4/ 3 svecchayā yute jāte yāvattāvatkālakamāne 4/ 18 vā 17/ 5/

<sup>419</sup> evaṃ pañcakam iṣṭaṃ prakalpya jātāv abhinnau 7/ 5 AM ] ∅ G.

<sup>420</sup> yāva 1 yā 3 rū 6 G ] yāva 1 yā 3 rū 6 A, yāva 1 yā 3 rū 6 M;  $\frac{173}{7}$  AG ]  $\frac{172}{7}$  M.

<sup>421</sup> 'bhīṣṭāt AMGP ] 'bhīṣṭā T; bhaktveṣṭeneṣṭa AMP ] bhakteṣṭeneṣṭa GT.

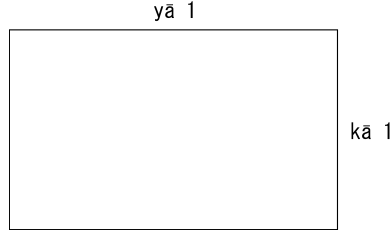
<sup>422</sup> varṇāṅkau AMTP ] varṇāṅka G; jñātavye AMGP ] ∅ T.

<sup>423</sup> varṇau MG ] varṇauṃ A; rūpayutaṃ AM ] rūpayutena G; tv ] tu AMG; ālāpo MG ] ālopo A.

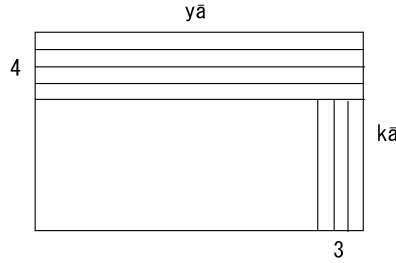
<sup>424</sup> Cited from BG E106.

dvikena jāte 5/ 11 vā 10/ 6//93p2//<sup>425</sup>

asyopapattiḥ/ sā ca dvidhā sarvatra syāt/ ekā kṣetrāgatānyā rāśīgateti/ tatra kṣetrāgatocyate/ dvitīyapakṣaḥ kila bhāvitasamo vartate/ bhāvitaṃ tv āyata-caturasrakṣetrāphalam/ tatra varṇau bhujakoṭī/ nyāsaḥ/



atra kṣetrāntar yāvaccatuṣṭayaṃ vartate kālakatrayaṃ dve ca rūpe/ ataḥ kṣetrād yāvattāvaccatuṣṭaye rūpacatuṣṭayonakālake svāṅkaḡe cāpanīte jātam/ nyāsaḥ/



dvitīyapakṣe ca tathā kṛte jātam 14/ etad bhāvitaḡetrāntarvartino 'vaśiṣṭa-kṣetrasyādhanastanasya phalam/ tad bhujakoṭivadhāj jātam/ te cātra jñātavye/ ata iṣṭo bhujāḡ kalpitastena phale 'smin 14 bhakte koṭir labhyate/ anayor bhujakoṭyor ekatarā yāvattāvadaṅkatulyai rūpair 4 adhikatarā satī bhāvitaḡetrasya koṭir bhavati yato bhāvitaḡetrād yāvattāvaccatuṣṭaye 'panīte tatkoṭiś caturūnā jātā/ evaṃ kālakaṅkatulyai rūpair 3 adhikataro bhujō bhavati/ te eva yāvattāvatkālaka-māne//93p3//<sup>426</sup>

atha rāśīgatopapattir ucyate/ sāpi kṣetramūlāntarbhūtā/ tatra yāvattāvatkālaka-

<sup>425</sup>prathamo MG ] pramo A; guṇayo MG ] guṇayī A; yākābhā 1 G ] yā.kā.bhā 1 AM.

<sup>426</sup>dve ca rūpe AM ] dve rūpe G; rūpacatuṣṭayonakālake AM ] rūpacatuṣṭayone kālake G; kṣetrasyādhanastanasya G ] kṣetrasthādhanastanasya AM; bhāvitaḡetrād AM ] bhāvitaḡetrasya G; kālakaṅkatulyai ] kālakatulyai AMG; te eva M ] ta eva AG. In AMG, the second figure is rotated anticlockwise by 90 degrees.

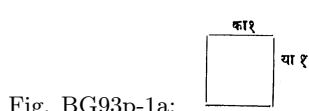


Fig. BG93p-1a:

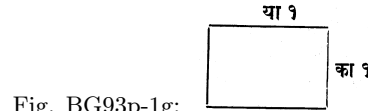


Fig. BG93p-1g:

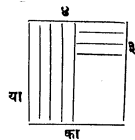


Fig. BG93p-2a:

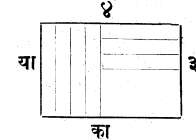


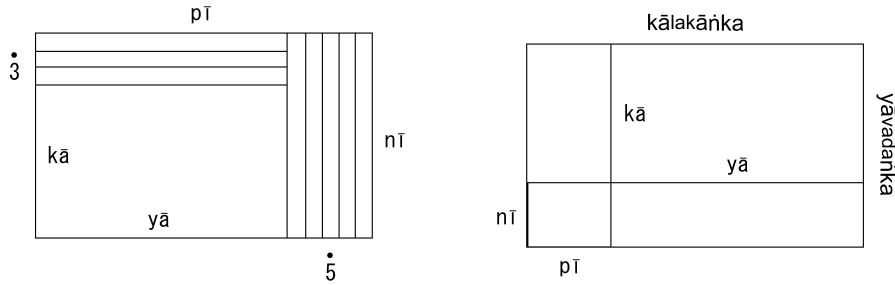
Fig. BG93p-2g:

bhujakoṭimānātmakakṣetrāntargatasya laghukṣetrasya bhujakoṭimāne 'nyavarṇau kalpitau nī 1/ pī 1/ ata etayor ekataro yāvattāvadaṅkatulyai rūpair adhiko bahiḥkṣetrakoṭeḥ kālakasya mānam/ anyaḥ kālakāṅkatulyai rūpair adhiko bhujasya yāvattāvato mānam kalpitam/ nī 1 rū 4/ pī 1 rū 3/ ābhyāṃ pakṣayor yāvattāvatkālaka-varṇāv utthāpyoparitanapakṣe nī 3 pī 4 rū 26/ bhāvitakṣetre ca nīpībhā 1 nī 3 pī 4 rū 12/ etayoḥ samaśodhane kṛte jātam adhaḥ nīpībhā 1 ūrdhvapakṣe rū 14/ idam eva tadantaḥkṣetrāphalam/ etad varṇāṅkayor ghātasya rūpayutasya samaṃ syād/ ato varṇamāne bhavatas tat prāg uktam eva (BG 93p3)/ iyam eva kriyā pūrvācāryaiḥ saṃkṣiptapāṭhena nibaddhā/<sup>427</sup> ye kṣetrāgatām upapattiṃ na budhyanti teṣāṃ iyam rāsīgatā darśanīyā//93p4//<sup>428</sup>

**upapattiyutaṃ bījagaṇitaṃ gaṇakā jaguḥ/  
na ced evaṃ viśeṣo 'sti na pāṭībījayor yataḥ//94//<sup>429</sup>**

94

ata iyam bhāvitopapattir dvidhā darśitā/ yat tūktam varṇāṅkayor ghāto rūpair yuto bhāvitakṣetrāntarvartino 'nyakṣetrasya koṇasthasya phalam iti tat kvacid anyathā syāt/ yathā/ yadā varṇāṅkāv ṛṇagatau bhavatas tadā tasyaivāntar bhāvitakṣetraṃ koṇe dṛśyate/ yadā tu bhāvitakṣetre bhujakoṭibhyāṃ varṇāṅkāv adhikau dhanagatau bhavatas tadā bhāvitakṣetrād bahiḥkoṇastham kṣetraṃ syāt/ tad yathā/ nyāsaḥ/



yadīdṛśaṃ tadeṣṭaphalābhyāṃ ūnitau varṇāṅkau yāvattāvatkālakayor māne bhavataḥ//93p5//<sup>430</sup>

udāharaṇam/E109p0/

<sup>427</sup>Cf. BSS 18.60, SSe 14.20–21ab.

<sup>428</sup>kālakāṅkatulyai ] kālakatulyaiḥ AM, kālakatulyai G; nī 1 rū 4/ pī 1 rū 3 G ] kā = nī 1 rū 4, yā = pī 1 rū 3 AM; nīpībhā 1 (twice) G ] nī.pī.bhā 1 AM.

<sup>429</sup>TP do not have this verse. upapatti AG ] upapāṭṭa M.

<sup>430</sup>yuto MG ] yutī A; 'nyakṣetrasya AM ] 'nyasya laghukṣetrasya G; yathā/ yadā G (without daṇḍa) ] yathā AM; koṇe dṛśyate M ] kaṇe dṛśyate A, koṇastham syāt G; māne bhavataḥ MG ] mā bhavataḥ A. In AMG, the first figure is turned over and rotated by 90 degrees, and the second is rotated clockwise by 90 degrees, both with 'nī' and 'pī' exchanged; 3 M ] 3 AG; 5 M ] 5 AG; yāvadaṅka ] ∅ AMG; kālakāṅka ] ∅ AMG. For the numerals, 3 and 5, in the first figure see E110.



**dviḡuṇena kayo rāśyor ghātena sadr̥ṣaṃ bhavet/**

E109

**daśendrāhatarāśyaikyam̐ dvyūnaṣaṣṭivivarjitam//E109//<sup>431</sup>**

atra rāśī yā 1/ kā 1/ anayor yathokte kṛte bhāvitānkena bhakte jātam yā 5 kā 7  
rū 29/ atra ‘varṇānkāhatirūpaikyam’ (BG 92e) 6 dvihṛtam iṣṭaphale 2/ 3/ ābhyāṃ  
varṇānkau yutau rāśī 10/ 7/ vā 9/ 8/ ūnitau jātau 4/ 3/ vā 5/ 2//E109p//  
udāharaṇam/E110p0/

**tripaṅcagūṇarāśibhyāṃ yuto rāśyor vadhaḥ kayoḥ/**

E110

**dviṣaṣṭipramito jātas tau rāśī vetsi ced vada//E110//<sup>432</sup>**

atra yathokte kṛte jātau pakṣau

yā	3	kā	5	rū	62
		yākābhā	1		

‘varṇānkāhatirūpaikyam’ (BG 92e) 77/ iṣṭataphale 7/ 11/ ābhyāṃ varṇānkau  
yutāv eva/ iṣṭataphalābhyāṃ ābhyāṃ 7/ 11 ūnitau ced vidhīyete tadaraṇagatau  
bhavataḥ/ ata ābhyāṃ 7/ 11 yutau jātau rāśī 6/ 4/ vā 2/ 8/ ūnitau 12/ 14/ vā 16/  
10//E110p1//<sup>433</sup>

atha pūrvatṛtīyodāharaṇam/Q13p0/<sup>434</sup>

**‘yau rāśī kila yā ca rāśinihatir yau rāśivargau tathā**

Q13

**teṣāṃ aikyapadaṃ sarāśiyugalaṃ (jātā trayoviṃśatiḥ)’//**

**Q13//<sup>435</sup>**

iti/ atra rāśī yā 1/ kā 1/ anayor ghātayutivargāṇāṃ yogaḥ yāva 1 kāva 1 yākābhā  
1 yā 1 kā 1/ asya mūlābhāvād rāśidvayonāyās trayoviṃśateḥ yā 1 kā 1 rū 23 varge-  
ṇānena yāva 1 kāva 1 yākābhā 2 yā 46 kā 46 rū 529 sāmyam/ tatra samayoga-

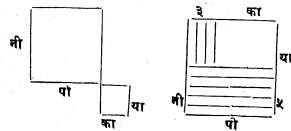


Fig. BG93p-3a:

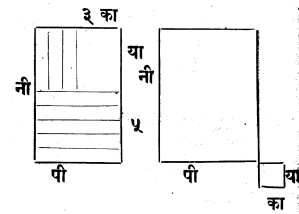


Fig. BG93p-3g:

<sup>431</sup>kayo GTP ] kayoḥ AM; dvyūna MGTP ] dvayūna A.

<sup>432</sup>yuto AMGT ] yukto P; tau rāśī G ] rāśiṃ tvam̐ AM, rāśī tvam̐ TP.

<sup>433</sup>yākābhā 1 G ] yā.kā.bhā 1 A, yā.kā.bhā M; yutāv eva G ] yutāveva kāryau AM; vā (2nd) AM ]  
∅ G.

<sup>434</sup>tṛtīyodāharaṇam ] caturthodāharaṇam AMG.

<sup>435</sup>Cited from BG E108ab.

viyogādaṁ samataiveti samavargagame śodhane ca kṛte bhāvitāṅkena hṛte jātam yā  
47 kā 47 rū 529/ atra varṇāṅkāhatī rūpayutā 1680/ iyaṁ catvāriṁśateṣṭena hṛtā  
phalam 42/ iṣṭam 40/ atreṣṭaphalābhyāṁ ābhyāṁ varṇāṅkāḥ ūnāv eva kāryau/  
tena jātau rāśī 7/ 5/ yutau cet kriyete tarhi ‘jātā trayoviṁśatiḥ’ (BG E108b) iti  
pūrvālāpo na ghaṭate//E110p2//<sup>436</sup>  
caturthodāharaṇam/Q14p0/<sup>437</sup>

‘pañcāśat triyutāthavā’//Q14//<sup>438</sup>

Q14

iti/ atrodāharaṇe yathokte kṛte bhāvitāṅkena vibhakte jātam yā 107 kā 107 rū  
2809/ atra ‘varṇāṅkāhatirūpaikyam’ (BG 92e) 8640/ iṣṭataphale 90/ 96/ ābhyāṁ  
varṇāṅkāḥ ūnitau rāśī 11/ 17/ evam anyatrāpi//E110p3//<sup>439</sup>

kvacid bahuṣu sāmyeṣu bhāvītonmitīr ānīya tābhyāḥ samīkṛtacchedagamābhyāḥ  
sāmye pūrvabījākriyayaiva rāśī jñāyete/ atra rāśī iti dvivacanopādānād anyeṣāṁ  
ṛṭṭiyādivarṇānām iṣṭāni mānāni kalpyānīty arthāt siddham//E110p4//<sup>440</sup>

iti bhāskarīye bījagaṇite bhāvitāṁ samāptam//E110p5//<sup>441</sup>

## II.12 Grantha-samāpti

āsīn maheśvara iti prathitaḥ pṛthivyām	95
ācāryavaryapadavīm viduṣāṁ prapannaḥ/ labdhvāvabodhakalikāṁ tata eva cakre tajjena bījagaṇitaṁ laghu bhāskareṇa//95// <sup>442</sup>	
brahmāhvayaśrīdharapadmanābha- bījāni yasmād ativistṛtāni/ ādāya tatsāram akāri nūnaṁ sadyuktīyuktaṁ laghu śiṣyatuṣṭyai//96// <sup>443</sup>	96
atrānuṣṭupsahasraṁ hi sasūtroddeśake mitiḥ/	97

<sup>436</sup>yugalam AM ] yutaṁ G; dvayonāyās AM ] dvayona G; yākābhā 1 G ] yā.kābhā 1 AM;  
trayoviṁśateḥ G ] trayorviṁśateḥ AM; yākābhā 2 G ] yā.kā.bhā 2 AM; catvāriṁśateṣṭena AG ]  
catvāriṁśateṣṭaina M; tena jātau MG ] te jātau A; jāta AM ] jātaṁ G.

<sup>437</sup>caturthodāharaṇam G ] pūrvodāharaṇam AM.

<sup>438</sup>Cited from BG E108c.

<sup>439</sup>yathokte kṛte ] yathoktakṛta AMG; 2809 AM ] 2809 G.

<sup>440</sup>dvivacanopādānād G ] dvivacanād AM; ṛṭṭiyādi ] tryādi AM, ādi G.

<sup>441</sup>bhāskarīye ] śrībhāskarācāryaviracite AM, śrībhāskarīye G; samāptam AM ] ∅ G.

<sup>442</sup>prapannaḥ AM ] prayātaḥ GTP.

<sup>443</sup>brahmāhvaya TP ] brāhmāhvaya AMG.

kvacit sūtrārthaviṣayaṃ vyāptim darśayitum kvacit//97//<sup>444</sup>  
 kvacic ca kalpanābhedam kvacid yuktim udāhṛtam/ 98  
 na hy udāharaṇānto 'sti stokam uktam idam yataḥ//98//  
 dustaraḥ stokabuddhīnām śāstravistāravāridhiḥ/ 99  
 athavā śāstravistrītyā kiṃ kāryaṃ sudhiyām api//99//<sup>445</sup>  
 upadeśalavaṃ śāstraṃ kurute dhīmato yataḥ/ 100  
 tat tu prāpyaiva vistāraṃ svayam evopagacchati//100//<sup>446</sup>  
 'jale tailaṃ khale guhyaṃ pātre dānaṃ manāg api/ 101  
 prājñe śāstraṃ svayaṃ yāti vistāraṃ vastuśaktitaḥ'//101//<sup>447</sup>

[tathā gole mayoktam/ ullasadamalāmatīnām trairāśīkamātram eva pāṭī buddhir  
 eva bījam/ tathā golādhyāye mayoktam/Q15p0/

'asti trairāśīkaṃ pāṭī bījam ca vimalā matiḥ/  
 kim ajñātaṃ subuddhīnām ato mandārtham ucyate'//Q15//<sup>448</sup> Q15

//101p//<sup>449</sup>

gaṇaka bhaṇitiramyam bālalilāvagamyaṃ 102  
 sakalagaṇitasāraṃ sopapattiprakāram/  
 iti bahugūṇayuktaṃ sarvadoṣair vimuktaṃ  
 paṭha paṭha mativṛddhyai laghv idam prauḍhasiddhyai//  
 102//<sup>450</sup>

iti bhāskarīye siddhāntaśīromaṇau bījagaṇitādhyāyaḥ samāptaḥ//102p//<sup>451</sup>

<sup>444</sup>After 97ab, TP have an Anuṣṭubh hemistich, 'kvacit sūtrārthaviṣayaṃ darśayitum udāhṛtam', which AMG do not. It has the same meaning as 97c. atrānuṣṭup GTP ] atrānup AM.

<sup>445</sup>vistāra AMTP ] vistara G.

<sup>446</sup>gacchati AMGP ] gacchatti T.

<sup>447</sup>Cited from CV 14.5. An introductory phrase for 101, 'yathoktaṃ yantrādhyāye', occurs in AM but not in GTP (the editor of G remarks that the phrase is found in most mūla-pustakas). dānaṃ AGT ] pānaṃ M, dāna P.

<sup>448</sup>Cited from GA, praśna 3.

<sup>449</sup>BG 101p (the inside of the square brackets) occurs in AM but not in GTP (the editor of G remarks that this passage is seen in most mūla-pustakas but that it has not been accepted by commentators).

<sup>450</sup>bhaṇiti AMG ] bhaṇati TP; prauḍha MGTP ] proḍha A.

<sup>451</sup>TP omit this colophon. bhāskarīye ] śrībhāskarācāryaviracite AM, śrībhāskarīye G.

## III Appendices

### III.1 Rules and Examples of the *Bījagaṇita*

Here I briefly describe the mathematical rules and examples given in the verses of the BG and the solutions of the examples given in the prose parts. I express them in modern algebraic notation for easy reference and apprehension.

#### III.1.1 Chapter 1: Six kinds of operations on positive and negative numbers

##### 1: Salutation.

Bhāskara salutes to (1) avyakta (the invisible), which is the sole primary seed of all the visible material world conceived by the Sāṃkhya philosophy, (2) īśa (the Lord), who is the unique supreme seed of all that is visible, and (3) avyakta-gaṇita (the invisible mathematics or the mathematics with unknown numbers), which is the seed of the vyakta-gaṇita (the visible mathematics or the mathematics with known numbers).

##### 2: Introduction.

‘Since the visible ⟨mathematics⟩ (i.e., mathematics with known numbers) told before ⟨by me in the *Līlāvātī*⟩ has the invisible ⟨mathematics⟩ as its seed, and since, without the reasoning of the invisible ⟨mathematics⟩, problems can hardly be understood (i.e., solved) ⟨even by intelligent persons and⟩ not at all by less-intelligent persons, I speak about the operations with seeds.’

Cf. Q2, 73, 94, and Q15

##### 3ab: Addition.

Let  $a$  and  $b$  be positive numbers. Then

$$a + b = a + b, \quad \overset{\bullet}{a} + \overset{\bullet}{b} = \overset{\bullet}{a + b},$$
$$a + \overset{\bullet}{b} = \begin{cases} a - b & (b < a) \\ \overset{\bullet}{b - a} & (a < b) \end{cases}, \quad \overset{\bullet}{a} + b = \begin{cases} \overset{\bullet}{a - b} & (b < a) \\ b - a & (a < b) \end{cases}.$$

##### E1:

$$1. \overset{\bullet}{3} + \overset{\bullet}{4} = \overset{\bullet}{7}. \quad 2. 3 + 4 = 7. \quad 3. 3 + \overset{\bullet}{4} = \overset{\bullet}{1}. \quad 4. \overset{\bullet}{3} + 4 = 1.$$

##### 3cd: Subtraction.

Let  $a$  and  $b$  be positive numbers. Then

$$a - b = a + \overset{\bullet}{b}, \quad \overset{\bullet}{a} - \overset{\bullet}{b} = \overset{\bullet}{a} + b, \quad a - \overset{\bullet}{b} = a + b, \quad \overset{\bullet}{a} - b = \overset{\bullet}{a} + \overset{\bullet}{b}.$$

To these the rule for the sum (3ab) is applied.

**E2ab:**

$$1. 3 - 2 = 1. \quad 2. \overset{\bullet}{3} - \overset{\bullet}{2} = \overset{\bullet}{1}. \quad 3. 3 - \overset{\bullet}{2} = \overset{\bullet}{5}. \quad 4. \overset{\bullet}{3} - 2 = \overset{\bullet}{5}.$$

**4a:** Multiplication.

Let  $a$  and  $b$  be positive numbers. Then

$$a \times b = ab, \quad \overset{\bullet}{a} \times \overset{\bullet}{b} = ab, \quad a \times \overset{\bullet}{b} = \widehat{ab}, \quad \overset{\bullet}{a} \times b = \widehat{ab}.$$

**E2cd:**

$$1. 2 \times 3 = 6. \quad 2. \overset{\bullet}{2} \times \overset{\bullet}{3} = 6. \quad 3. 2 \times \overset{\bullet}{3} = \overset{\bullet}{6}. \quad 4. \overset{\bullet}{2} \times 3 = \overset{\bullet}{6}.$$

**4b:** Division.

Let  $a$  and  $b$  be positive numbers. Then

$$a \div b = a/b, \quad \overset{\bullet}{a} \div \overset{\bullet}{b} = a/b, \quad a \div \overset{\bullet}{b} = \widehat{a/b}, \quad \overset{\bullet}{a} \div b = \widehat{a/b}.$$

**E3:**

$$1. 8 \div 4 = 2. \quad 2. \overset{\bullet}{8} \div \overset{\bullet}{4} = 2. \quad 3. \overset{\bullet}{8} \div 4 = \overset{\bullet}{2}. \quad 4. 8 \div \overset{\bullet}{4} = \overset{\bullet}{2}.$$

**4cd:** Square and square-root.

Let  $a$  be a positive number. Then

$$a^2 = a^2, \quad (\overset{\bullet}{a})^2 = a^2,$$

square-roots of  $a = \sqrt{a}$  and  $\sqrt{\overset{\bullet}{a}}$ ,

$\overset{\bullet}{a}$  does not have a square-root.

**E4ab:** Square.

$$1. 3^2 = 9. \quad 2. \left(\overset{\bullet}{3}\right)^2 = 9.$$

**E4cd:** Square-root.

1. Square-roots of  $9 = 3$  and  $\overset{\bullet}{3}$ . 2.  $\overset{\bullet}{9}$  does not have a square-root.

### III.1.2 Chapter 2: Six kinds of operations on zero

**5ab:** Addition and subtraction.

Let  $a$  be a positive number. Then

$$a + 0 = 0 + a = a, \quad \overset{\bullet}{a} + 0 = 0 + \overset{\bullet}{a} = \overset{\bullet}{a}, \quad a - 0 = a, \quad \overset{\bullet}{a} - 0 = \overset{\bullet}{a},$$

$$0 - a = \overset{\bullet}{a}, \quad 0 - \overset{\bullet}{a} = a.$$

**E5ab:**

1.  $\overset{\bullet}{3} + 0 = 0 + 3 = 3$ .    2.  $\overset{\bullet}{3} + 0 = 0 + \overset{\bullet}{3} = \overset{\bullet}{3}$ .    3.  $0 + 0 = 0$ .    4.  $0 - 3 = \overset{\bullet}{\bar{3}}$ .  
 5.  $0 - \overset{\bullet}{3} = 3$ .    6.  $0 - 0 = 0$ .

**5cd:** Multiplication, division, square, square-root.

Let  $a$  be a positive or a negative number. Then

$$\begin{aligned} 0 \times a &= a \times 0 = 0, \\ 0 \div a &= 0, \quad a \div 0 = \frac{a}{0} \text{ (zero-divisor),} \\ 0^2 &= 0, \quad \sqrt{0} = 0. \end{aligned}$$

**E5cd:**

1.  $0 \times 2 = 0$ .    2.  $0 \div 3 = 0$ .    3.  $3 \div 0 = \frac{3}{0}$  (zero-divisor).    4.  $0^2 = 0$ .    5.  $\sqrt{0} = 0$ .

**6:** Zero-divisor and God: a simile.

Bhāskara compares the zero-divisor to God (Viṣṇu) for its infinite (ananta) and permanent (acyuta) nature:  $\frac{a}{0} \pm b = \frac{a}{0}$ . For the story on which this simile is based, see *Mahābhārata*, Poona ed., 6.30.17–19 and 6.31.7–8.

*III.1.3 Chapter 3: Six kinds of operations on unknown numbers**Section 3.1: Six kinds of operations on an unknown number***7:** Names of the values of unknown numbers.

The relative adverb *yāvattāvat* and the color names *kālaka*, *nīlaka*, *pīta*, *lohita*, etc. are employed for designating unknown numbers.

In BG 68p1, Bhāskara refers to additional color names and the consonants, *ka* etc., to be used for the same purpose. In BG E44p, he says that intelligent persons (*matimat*) may use the initial letters of the names of the things whose quantities are to be known.

In this appendix, I use  $x$ ,  $y$ ,  $z$ , etc. for the original unknown numbers of a particular problem and  $s_1$ ,  $s_2$ ,  $s_3$ , etc. for *yāvattāvat*, *kālaka*, *nīlaka*, etc. If the problem involves only one unknown number, then I use  $x$  for the original unknown number and  $s$  for *yāvattāvat*.

**8ab:** Addition and subtraction.

Of two names (letters) of the same kind (*samāna-jāti*), the sum or the difference is taken. Two names of different kinds (*vibhinna-jāti*) stand separately.

For the sake of convenience, I hereafter write ‘ $-a$ ’ in place of ‘ $\overset{\bullet}{a}$ ’: for example, ‘ $(x + 1) + (2x - 8) = 3s - 7$ ’ in place of ‘ $(x + 1) + (2x + \overset{\bullet}{8}) = 3s + \overset{\bullet}{7}$ ’ (E6.1), and ‘ $2x - (-6x + 8) = 8s - 8$ ’ in place of ‘ $2x - (\overset{\bullet}{6}x + 8) = 8s + \overset{\bullet}{8}$ ’ (E7cd).

**E6:** Addition.

$$1. (x + 1) + (2x - 8) = 3s - 7. \quad 2. (-x - 1) + (2x - 8) = s - 9. \quad 3. \\ (x + 1) + (-2x + 8) = -s + 9. \quad 4. (-x - 1) + (-2x + 8) = -3s + 7.$$

**E7ab:** Addition.

$$(3x^2 + 3) + (-2x) = 3s^2 - 2s + 3.$$

**E7cd:** Subtraction.

$$2x - (-6x + 8) = 8s - 8.$$

**8cd–9:** Multiplication, division, square, square-root.

A color  $\times$  rūpas = the color; product of the same color = power (square, cube, etc.) of the color; product of different colors = bhāvita ('what is produced'); apply the rules given in the L to the rest (division, square, square-root).

**10:** Multiplication by parts (khaṇḍa-guṇanā).

The same algorithm that is given in L 14cd. This algorithm can be used also for the square of unknown numbers and for the multiplication and the square of karaṇīs.

**E8:** Multiplication.

$$1. (5s - 1) \times (3s + 2) = 15s^2 + 7s - 2. \quad 2. (-5s + 1) \times (3s + 2) = -15s^2 - 7s + 2. \\ 3. (5s - 1) \times (-3s - 2) = -15s^2 - 7s + 2. \quad 4. (-5s + 1) \times (-3s - 2) = 15s^2 + 7s - 2.$$

**11:** Division.

The same algorithm that is given in L 18ab but worded for the division involving colors (unknown numbers).

$$\text{Examples in 11p1 (the reverse of E8): } 1. (15s^2 + 7s - 2) \div (3s + 2) = (5s - 1). \quad 2. \\ (-15s^2 - 7s + 2) \div (3s + 2) = (-5s + 1). \quad 3. (-15s^2 - 7s + 2) \div (-3s - 2) = (5s - 1). \\ 4. (15s^2 + 7s - 2) \div (-3s - 2) = (-5s + 1).$$

**E8ef:** Square.

$$(4s - 6)^2 = 16s^2 - 48s + 36.$$

**12:** Square-root.

Take the square-roots of the squares of colors contained in the given quantity and subtract twice the product of every twos of those roots from the rest. If the given quantity contains a rūpa, take its square-root first.

Example in 12p1 (the reverse of E8ef): the square-root of  $(16s^2 - 48s + 36) = 4s - 6$ .

Kṛṣṇa refers to the other root, yā 4 rū 6 or  $(-4s + 6)$ , and Colebrooke includes it in his translation but AMG do not mention it. Of course, Bhāskara knew the existence of two roots of a positive number (cf. BG 4c, 21 and E14cd) but his intention here is to obtain the very root from which the square is obtained in the previous problem (E8ef). See the first sentence of 12p1. For a similar case see E10p5. He attaches

much importance to the intention of the questioner (praṣṭṛ): when there is more than one solution (or more than one expression of solution), he chooses one that has been intended by the questioner. Cf. ‘tathā yathā praṣṭur abhīpsitāḥ syuḥ’ (BG 17d). Cf. also 18p3 and 20p4.

*Section 3.2: Six kinds of operations on more than one color*

**E9:** Addition and subtraction.

$$1. (3s_1 + 5s_2 + 7s_3) + (-2s_1 - 3s_2 - s_3) = s_1 + 2s_2 + 6s_3. \quad 2. (3s_1 + 5s_2 + 7s_3) - (-2s_1 - 3s_2 - s_3) = 5s_1 + 8s_2 + 8s_3.$$

**E10:** Multiplication, division, square, square-root.

$$1. (-3s_1 - 2s_2 + 1s_3 + 1) \times (-6s_1 - 4s_2 + 2s_3 + 2) = 18s_1^2 + 8s_2^2 + 2s_3^2 + 24s_1s_2 - 12s_1s_3 - 8s_2s_3 - 12s_1 - 8s_2 + 4s_3 + 2. \quad 2. (\text{the reverse of 1}) (18s_1^2 + 8s_2^2 + 2s_3^2 + 24s_1s_2 - 12s_1s_3 - 8s_2s_3 - 12s_1 - 8s_2 + 4s_3 + 2) \div (-3s_1 - 2s_2 + 1s_3 + 1) = -6s_1 - 4s_2 + 2s_3 + 2. \\ 3. (-3s_1 - 2s_2 + 1s_3 + 1)^2 = 9s_1^2 + 4s_2^2 + 1s_3^2 + 12s_1s_2 - 6s_1s_3 - 4s_2s_3 - 6s_1 - 4s_2 + 2s_3 + 1. \\ 4. (\text{the reverse of 3}) \text{ the square-root of } (9s_1^2 + 4s_2^2 + s_3^2 + 12s_1s_2 - 6s_1s_3 - 4s_2s_3 - 6s_1 - 4s_2 + 2s_3 + 1) = -3s_1 - 2s_2 + 1s_3 + 1. \text{ For the choice of this root see the notes under BG 12 above.}$$

*III.1.4 Chapter 4: Six kinds of operations on karaṇīs*

**13–14:** Addition and subtraction.

Let ka  $c = ka a \pm ka b$  ( $a > b$ ). Let also  $ab$  be a square number and

$$L = a + b, \quad S = 2\sqrt{ab}.$$

Then

$$c = L \pm S.$$

Or, otherwise,

$$c = \left( \sqrt{\frac{a}{b}} \pm 1 \right)^2 \times b.$$

Multiplication and division. ‘One should multiply a square by a square and divide a square by a square.’ Since  $a$  of ‘ka  $a$ ’ is a number in the square power,

$$\begin{array}{ll} c = ab & \text{when ka } c = \text{ka } a \times \text{ka } b \\ c = ab^2 & \text{when ka } c = \text{ka } a \times \text{rū } b \\ c = a^2b & \text{when ka } c = \text{rū } a \times \text{ka } b \\ c = a \div b & \text{when ka } c = \text{ka } a \div \text{ka } b \\ c = a \div b^2 & \text{when ka } c = \text{ka } a \div \text{rū } b \\ c = a^2 \div b & \text{when ka } c = \text{rū } a \div \text{ka } b \end{array}$$

**E11:** Addition and subtraction.



- 1a. ka 2 + ka 8 = ka 18. 1b. ka 8 - ka 2 = ka 2. 2a. ka 3 + ka 27 = ka 48.  
 2b. ka 27 - ka 3 = ka 12. 3a. ka 3 + ka 7 = ka 3 + ka 7 (set down separately).  
 3b. ka 7 - ka 3 = ka  $\overset{\bullet}{3}$  + ka 7 (set down separately).

**E12:** Multiplication and division.

1. (ka 3 + rū 5) × (ka 2 + ka 3 + ka 8) = rū 3 + ka 450 + ka 75 + ka 54. 2. (ka 3 + rū 5) × (ka 3 + ka 12 - rū 5), which is solved after the following rule.

**15:** Special rule for the sign in the conversion of a rūpa to a karaṇī and vice versa:

rū  $\overset{\bullet}{a}$  = ka  $\widehat{(a^2)}$ , which means, in modern notation,  $-a = -\sqrt{a^2}$ . I shall write it as ‘-rū a = -ka a<sup>2</sup>.’

Solution of E12.2: (ka 3 + rū 5) × (ka 3 + ka 12 - rū 5) = ka 300 - rū 16. (E12p2)

Ex. 1 for division (the reverse of E12.1) in E12p4. (rū 3 + ka 450 + ka 75 + ka 54) ÷ (ka 2 + ka 3 + ka 8) = rū 5 + ka 3. Ex. 2 for division (the reverse of E12.2) in E12p5. (ka 300 - rū 16) ÷ (ka 3 + ka 12 - rū 5) = ka 3 + rū 5.

In E12p4–p5, the divisions are made by means of the same algorithm that is given in L 18ab. Cf. BG 11 above. Another algorithm for division is given in the next two verses.

**16–17:** Division by rationalization of the divisor.

‘Having made the sign of any optionally chosen karaṇī in the divisor reversed, one should multiply the dividend and the (original) divisor by such an (altered) divisor repeatedly until a single karaṇī is left in the divisor. By that (karaṇī) the karaṇīs in the dividend should be divided. If there are some (karaṇīs) produced by addition (in the answer), they should be decomposed by means of the decomposition rule so that they become the ones desired by the questioner.’

The decomposition rule is given in the next verse.

**18:** Decomposition rule.

If  $c = a^2b$  and  $a = a_1 + a_2$ , then ka  $c = ka a_1^2b + ka a_2^2b$ .

Ex. 1 for division in 18p1 (the same divisor and dividend as in E12p4). Ex. 2 for division in 18p2 (the same divisor and dividend as in E12p5). Ex. 3 for division in 18p3 (the reverse of E12.1). (rū 3 + ka 450 + ka 75 + ka 54) ÷ (rū 5 + ka 3) = ka 18 + ka 3 = ka 2 + ka 3 + ka 8, where ka 18 is made into ka 2 and ka 8 by means of the decomposition rule.

**E13–14ab:** Square and square-root.

1. (ka 2 + ka 3 + ka 5)<sup>2</sup> = rū 10 + ka 24 + ka 40 + ka 60. 2. (ka 3 + ka 2)<sup>2</sup> = rū 5 + ka 24. 3. (ka 6 + ka 5 + ka 3 + ka 2)<sup>2</sup> = rū 16 + ka 120 + ka 72 + ka 60 + ka 48 + ka 40 + ka 24. 4. (ka 18 + ka 8 + ka 2)<sup>2</sup> = (ka 72)<sup>2</sup> = ka 5184. 5 (the reverse of 4). Square-root of ka 5184 = rū 72.

For the square, Bhāskara refers to a slightly modified algorithm of L 19 and to the algorithm of BG 10.

**19–20:** Square-root.

Suppose that the square-root of  $r_0 + ka k_1 + ka k_2 + \dots + ka k_n$  is required. 1) Find  $a_1$  such that  $r_0^2 - \sum_j k_j = a_1^2$  for some  $k_j$ 's and obtain  $r_1 = \frac{r_0 + a_1}{2}$  and  $\ell_1 = \frac{r_0 - a_1}{2}$ . 2) If there remain  $k_i$ 's, find  $a_2$  from  $r_1$  (which is assumed to be a rūpa) and the remaining  $k_i$ 's in the same way and obtain  $r_2 = \frac{r_1 + a_2}{2}$  and  $\ell_2 = \frac{r_1 - a_2}{2}$ . 3) If there still remain  $k_i$ 's, repeat the same until all the original  $k_i$ 's are exhausted. Let  $r_m$  and  $\ell_m$  be the last pair obtained. Then,  $ka \ell_1 + ka \ell_2 + \dots + ka \ell_m + ka r_m$  is the square-root of the given quantity.

Ex. 1 in 20p1 (the reverse of E13–14ab.1). Square-root of  $r_0 + ka 24 + ka 40 + ka 60 = ka 2 + ka 3 + ka 5$ . Ex. 2 in 20p2 (the reverse of E13–14ab.2). Square-root of  $r_0 + ka 24 = ka 3 + ka 2$ . Ex. 3 in 20p3 (the reverse of E13–14ab.3). Square-root of  $r_0 + ka 120 + ka 72 + ka 60 + ka 48 + ka 40 + ka 24 = ka 6 + ka 5 + ka 3 + ka 2$ . Ex. 4 in 20p4 (the reverse of E13–14ab.4). Square-root of  $r_0 + ka 72 = ka 2 + ka 8 + ka 18$ .

**21:** Rule for the square-root of a number containing negative karaṇīs.

If the given number contains negative karaṇīs, then assume them to be positive, apply the above rule (BG 19–20), and at each step make either  $r_i$  or  $\ell_i$ , as the case might be, negative.

**E14cd:** Square and square-root.

1.  $(-ka 3 + ka 7)^2 = r_0 - ka 84$ . 2.  $(ka 3 - ka 7)^2 = r_0 - ka 84$ . 3 (the reverse of 1 and 2). Square-root of  $r_0 - ka 84 = -ka 3 + ka 7$  or  $ka 3 - ka 7$ .

**E15:** Square and square-root.

1.  $(ka 2 + ka 3 - ka 5)^2 = r_0 + ka 24 - ka 40 - ka 60$ . 2.  $(-ka 2 - ka 3 + ka 5)^2 = r_0 + ka 24 - ka 40 - ka 60$ . 3 (the reverse of 1 and 2). Square-root of  $r_0 + ka 24 - ka 40 - ka 60 = ka 2 + ka 3 - ka 5$  or  $-ka 2 - ka 3 + ka 5$ .

**22–25:** The number of karaṇīs in a square number and the properties of the pairs obtained at each step of the square-root procedure (BG 19–20).

1. In the following table,  $A$  is the number of karaṇīs in a certain composite karaṇī,  $B$  the number of karaṇīs in its square, and  $C$  the number of karaṇīs to be subtracted from the square of the rūpa at each step of the square-root procedure.

$A$	2	3	4	5	6	...	$n$	...
$B$	1	3	6	10	15	...	$\frac{n(n-1)}{2}$	...
$C$	$\langle 1 \rangle$	2	3	4	5	...	$(n-1)$	...

$B$  is the number of possible combinations when two things (karaṇīs) are taken at a time from  $n$  things (karaṇīs in the root), a number which is equal to the sum of natural series (called saṃkalita) up to  $(n-1)$ . If  $B$  and  $C$  do not match, then the

root obtained is not correct (na sat).

2. All the karaṇīs ( $k_j$ 's) that are subtracted from the square of the rūpa at the  $i$ -th step of the square-root procedure are divisible by  $4\ell_i$ , and every  $k_j/4\ell_i$  is part of the root. If not, the root obtained is incorrect (asat).

For Bhāskara's rules for the number of combinations and for the sum of natural series, see L 112–114 and 117ab, respectively.

**E16:** Non existence of square-root.

There is no square-root in karaṇīs (karaṇī-gata-mūla-abhāva) of rū 10 + ka 32 + ka 24 + ka 8.

**E17:** Non existence of square-root.

There is no square-root in karaṇīs of rū 10 + ka 60 + ka 52 + ka 12.

**E18:** Non existence of square-root.

There is no square-root in karaṇīs of rū 10 + ka 8 + ka 56 + ka 60.

**E19:** Non existence of square-root.

There is no square-root in karaṇīs of rū 13 + ka 48 + ka 60 + ka 20 + ka 44 + ka 32 + ka 24.

In E19p Bhāskara remarks that in these problems one should obtain an approximate square-root (āsanna-mūla) of each karaṇī, add them to the rūpa, and tell an (approximate) square-root.

**E20:** Slight alteration of the square-root procedure (BG 19–20).

Square-root of rū 17 + ka 40 + ka 80 + ka 200 = ka 10 + ka 5 + ka 2. In this problem one should assume  $\ell_1$  (instead of  $r_1$ ) to be the rūpa of the next step.

### III.1.5 Chapter 5: Kuṭṭaka

In this chapter, linear indeterminate equations of the type  $y = \frac{ax+c}{b}$  are solved. I express these equations by KU ( $a, b, c$ ) [ $y, x$ ]. KU ( $a, b, c$ ) [ $d, e$ ] means  $(y, x) = (d, e)$  are solutions of KU ( $a, b, c$ ) [ $y, x$ ].

**26–27=L 242–243:** Preliminaries.

1. The dividend  $a$ , the divisor  $b$ , and the additive  $c$  should be reduced by the reducer (apavartana) or the greatest common factor, if possible. 2. If  $c$  cannot be divided by a common factor of  $a$  and  $b$ , the problem is wrong. 3. How to find the reducer of  $a$  and  $b$ : when they are mutually divided, the last remainder is the reducer (the so-called Euclidean algorithm). 4. The dividend  $a$  and the divisor  $b$  reduced by that reducer are called 'firm' (dṛḍha), that is to say, mutually prime.

**28–29=L 244–245:** Main rule.

1. Divide the ‘firm’  $a$  and  $b$  mutually. That is, put  $b$  below  $a$ , divide  $a$  by  $b$ , and put the remainder  $r_1$  below  $b$  and the quotient  $q_1$  to the left of it. Then, divide  $b$  by  $r_1$ , and put the remainder  $r_2$  below  $r_1$  and the quotient  $q_2$  to the left of it. The dividend at each step may have been deleted after the division. Continue this until unity is obtained as a remainder. The following is the case where  $r_4 = 1$ .

$$\begin{array}{r}
 a \\
 b \\
 q_1 \ r_1 \quad \Leftarrow : a = bq_1 + r_1 \\
 q_2 \ r_2 \quad \Leftarrow : b = r_1q_2 + r_2 \\
 q_3 \ r_3 \quad \Leftarrow : r_1 = r_2q_3 + r_3 \\
 q_4 \ 1 \quad \Leftarrow : r_2 = r_3q_4 + 1
 \end{array}$$

I express the mutual divisions (paraspara-bhajana) with the quotients and the remainders by PB  $\left[ \begin{array}{cccccc} a & b & r_1 & r_2 & r_3 & 1 \\ & & q_1 & q_2 & q_3 & q_4 \end{array} \right]$ .

2. Delete the right column and put the additive  $c$  below the last quotient and a zero below it. The column obtained is called vallī or a creeper.

$$\begin{array}{c}
 q_1 \\
 q_2 \\
 q_3 \\
 q_4 \\
 c \\
 0
 \end{array}$$

I express the vallī by Vall( $q_1, q_2, \dots, c, 0$ ).

3. To this vallī apply the following procedure repeatedly until the number of its terms becomes two. ‘Multiply the third term from the bottom by the penultimate, add the last to the product, and delete the last.’

$$\begin{array}{c}
 \beta \\
 \alpha
 \end{array}$$

I express this procedure by ‘>>’ as Vall( $q_1, q_2, \dots, c, 0$ ) >> Vall( $\beta, \alpha$ ).

4. ‘Pare’ or reduce, if possible,  $\beta$  and  $\alpha$  by means of the modulo operations mod  $a$  and mod  $b$ , respectively. Then,  $(y, x) = (\beta, \alpha)$  are the least positive solutions of KU( $a, b, c$ ) [ $y, x$ ]. This is the case where the number of the quotients of the mutual divisions ( $q_1, q_2, \dots$ ) is even as in the above. For the other case see the next verse.

**30=L 246:** Additional rule 1. When the number of quotients is odd.

When the number of the quotients is odd, KU( $a, b, c$ ) [ $a - \beta, b - \alpha$ ].

**31=L 248:** Additional rule 2. When  $a$  and  $c$  or  $b$  and  $c$  are reduced.

1. When  $a = a'p$  and  $c = c'p$ , if KU( $a', b, c'$ ) [ $\beta, \alpha$ ], then KU( $a, b, c$ ) [ $p\beta, \alpha$ ].

2. When  $b = b'p$  and  $c = c'p$ , if KU( $a, b', c'$ ) [ $\beta, \alpha$ ], then KU( $a, b, c$ ) [ $\beta, p\alpha$ ].

**32≈L 250:** Additional rule 3. When the sign of  $a$  or  $c$  is reversed. Quotients of modulo operations.

1. If  $KU(a, b, c) [\beta, \alpha]$ , then  $KU(a, b, -c) [a - \beta, b - \alpha]$ .
2. If  $KU(a, b, c) [\beta, \alpha]$ , then  $KU(-a, b, c) [-(a - \beta), b - \alpha]$ .
3. At step 4 of the main rule (BG 28–29), the quotients of the two modulo operations must be the same.

The L does not have a parallel to 32cd (2nd item of additional rule 3).

**33=L 252:** Additional rule 4. When  $c$  is pared down by  $b$ .

When  $c = bp + c'$ , if  $KU(a, b, \pm c') [\beta, \alpha]$ , then  $KU(a, b, \pm c) [\beta \pm p, \alpha]$ .

**34:** Additional rule 5. When both  $a$  and  $c$  are pared down by  $b$ .

When  $a = bp_1 + a'$  and  $c = bp_2 + c'$ , if  $KU(a', b, c') [\beta, \alpha]$ , then  $KU(a, b, c) [(a\alpha + c)/b, \alpha]$ .

The L does not have this verse (additional rule 5).

**35=L 254:** Additional rule 6. When  $c$  is divisible by  $b$ .

When  $c = 0$  or  $c = bp$ ,  $KU(a, b, c) [p, 0]$  (if  $c = 0$ , then  $p = 0$ ).

**36ab=L 256:** Additional rule 7. General solution.

If  $KU(a, b, c) [\beta, \alpha]$ , then  $KU(a, b, c) [\beta + ak, \alpha + bk]$ .

Hereafter, I use abbreviation AR for ‘additional rule.’

**E21=L 247:**  $KU(221, 195, 65) [y, x]$ .

$PB \begin{bmatrix} 221 & 195 & 26 & 13 & 0 \\ & & 1 & 7 & 2 \end{bmatrix}$ . Hence follows the ‘reducer’ (the greatest common factor) 13. The equation reduced by 13:  $KU(17, 15, 5) [y, x]$ .  $PB \begin{bmatrix} 17 & 15 & 2 & 1 \\ & & 1 & 7 \end{bmatrix}$ .  $Vall(1, 7, 5, 0) \gg Vall(40, 35)$ . By paring, the least positive solution is obtained:  $KU(17, 15, 5) [6, 5]$ . By AR 7, other solutions,  $KU(17, 15, 5) [23, 20]$ ,  $KU(17, 15, 5) [40, 35]$ , etc. are obtained.

**E22=L 249:**  $KU(100, 63, \pm 90) [y, x]$ .

1.  $KU(100, 63, 90) [y, x]$ .

Solution 1.  $PB \begin{bmatrix} 100 & 63 & 37 & 26 & 11 & 4 & 3 & 1 \\ & & 1 & 1 & 1 & 2 & 2 & 1 \end{bmatrix}$ .  $Vall(1, 1, 1, 2, 2, 1, 90, 0) \gg Vall(2430, 1530)$ . By paring,  $KU(100, 63, 90) [30, 18]$ . (E22p1)

Solution 2. Reduce the dividend and the additive by 10,  $KU(10, 63, 9) [y, x]$ .  $PB \begin{bmatrix} 10 & 63 & 10 & 3 & 1 \\ & & 0 & 6 & 3 \end{bmatrix}$ .  $Vall(0, 6, 3, 9, 0) \gg Vall(27, 171)$ . By paring, (7, 45). By AR 1,  $(y, x) = (10, 63) - (7, 45) = (3, 18)$ , or  $KU(10, 63, 9) [3, 18]$ . The multiplier 18 is accepted also for the original equation and  $y = (100 \cdot 18 + 90)/63 = 30$ . That is,  $KU(100, 63, 90) [30, 18]$ . Or, otherwise, by AR 2.1,  $KU(100, 63, 90) [30, 18]$ . (E22p2)

Solution 3. Reduce the divisor and the additive by 9,  $KU(100, 7, 10) [y, x]$ .  $PB \begin{bmatrix} 100 & 7 & 2 & 1 \\ & & 14 & 3 \end{bmatrix}$ .  $Vall(14, 3, 10, 0) \gg Vall(430, 30)$ . By paring, (30, 2). Therefore, by AR 2.2,  $KU(100, 63, 90) [30, 18]$ . (E22p3)

Solution 4. Reduce the divisor and the additive by 9 and then the dividend and the additive by 10, KU (10, 7, 1)  $[y, x]$ . PB  $\begin{bmatrix} 10 & 7 & 3 & 1 \\ & 1 & 2 & \end{bmatrix}$ . Vall(1, 2, 1, 0)  $\gg$  Vall(3, 2). By AR 2.1 and 2.2, KU (100, 63, 90) [30, 18]. By AR 7,  $(y, x) = (130, 81), (230, 144)$ , etc. are also solutions. (E22p4)

2. KU (100, 63, -90)  $[y, x]$ . From KU (100, 63, 90) [30, 18] obtained above, by AR 3.1, KU (100, 63, -90) [70, 45]. By AR 7,  $(y, x) = (170, 108), (270, 171)$ , etc. are also solutions. (E22p5)

**E23 $\approx$ L 251:** KU (-60, 13,  $\pm 3$ )  $[y, x]$ .

1. Solution of KU (-60, 13, 3)  $[y, x]$ . PB  $\begin{bmatrix} 60 & 13 & 8 & 5 & 3 & 2 & 1 \\ & 4 & 1 & 1 & 1 & 1 & \end{bmatrix}$ . Vall(4, 1, 1, 1, 1, 3, 0)  $\gg$  Vall(69, 15). By paring, (9, 2). By AR 1,  $(60, 13) - (9, 2) = (51, 11)$ . That is, KU (60, 13, 3) [51, 11]. By AR 3.2, KU (-60, 13, 3) [-9, 2].

2. Solution of KU (-60, 13, -3)  $[y, x]$ . From KU (-60, 13, 3) [-9, 2] obtained above, by AR 3.1, KU (-60, 13, -3) [-51, 11].

The corresponding verse in the L (251) gives a slightly different problem with the positive dividend 60: KU (60, 13,  $\pm 16$ )  $[y, x]$ .

In E23p2, Bhāskara cites two verses for supplementary rules. One (Q1) is of his own (BG 32cd) but the other (Q0) has not been identified.

**Q0:** Supplementary rule 1. When the signs of both  $a$  and  $c$  are reversed, or that of  $b$  or of  $c$  is reversed.

1. If KU ( $a, b, c$ )  $[\beta, \alpha]$ , then KU ( $-a, b, -c$ )  $[-\beta, \alpha]$ . (in Q0ab)

2. If KU ( $a, b, c$ )  $[\beta, \alpha]$ , then KU ( $a, b, -c$ )  $[a - \beta, b - \alpha]$ . This is the same as AR 3.1 (BG 32ab). (in Q0c)

3. If KU ( $a, b, c$ )  $[\beta, \alpha]$ , then KU ( $a, -b, c$ )  $[-\beta, \alpha]$ . (in Q0d)

**Q1 = 32cd:** When the sign of  $a$  is reversed.

If KU ( $a, b, c$ )  $[\beta, \alpha]$ , then KU ( $-a, b, c$ )  $[-(a - \beta), b - \alpha]$ .

Note that there are eight possible combinations of the signs of  $a$ ,  $b$ , and  $c$ , and that the corresponding solutions other than KU ( $a, b, c$ )  $[\beta, \alpha]$  can be obtained from it. Those seven cases are covered by BG 32 (except ef) and Q0 with overlap as follows (SR = supplementary rule).

KU ( $-a, b, c$ ) $[-(a - \beta), b - \alpha]$	AR 3.2 (32cd = Q1)
KU ( $a, -b, c$ ) $[-\beta, \alpha]$	SR 1.3 (Q0d)
KU ( $a, b, -c$ ) $[a - \beta, b - \alpha]$	AR 3.1 (32ab), SR 1.2 (Q0c)
KU ( $-a, -b, c$ ) $[a - \beta, b - \alpha]$	SR 1.3 (Q0d) from ( $-a, b, c$ )
KU ( $-a, b, -c$ ) $[-\beta, \alpha]$	SR 1.1 (Q0ab)
KU ( $a, -b, -c$ ) $[-(a - \beta), b - \alpha]$	SR 1.3 (Q0d) from ( $a, b, -c$ )
KU ( $-a, -b, -c$ ) $[\beta, \alpha]$	SR 1.3 (Q0d) from ( $-a, b, -c$ )

**E24:** KU (18, -11,  $\pm 10$ )  $[y, x]$ .

1. Solution of KU (18, -11, 10)  $[y, x]$ . PB  $\begin{bmatrix} 18 & 11 & 7 & 4 & 3 & 1 \\ & 1 & 1 & 1 & 1 & \end{bmatrix}$ . Vall(1, 1, 1, 1, 10, 0)  $\gg$  Vall(50, 30). By paring,  $(y, x) = (14, 8)$ . That is, KU (18, 11, 10) [14, 8]. Therefore, KU (18, -11, 10) [-14, 8].

2. Solution of KU (18, -11, -10)  $[y, x]$ . From KU (18, 11, 10) [14, 8] obtained above, by AR 3.1 (or SR 1.2), KU (18, 11, -10) [4, 3]. By SR 1.3, KU (18, -11, -10) [-4, 3].

The L does not have this verse (E24).

**E25=L 253:** KU (5, 3,  $\pm 23$ )  $[y, x]$ .

Solution 1. PB  $\begin{bmatrix} 5 & 3 & 2 & 1 \\ & 1 & 1 & \end{bmatrix}$ . Vall(1, 1, 23, 0)  $\gg$  Vall(46, 23). By paring with the quotient 7 for both, (11, 2). That is, KU (5, 3, 23) [11, 2]. By AR 3.1, KU (5, 3, -23) [-6, 1]. For positive solutions, apply AR 7:  $(-6, 1) + (5k, 3k) = (-6 + 5k, 1 + 3k)$ . When  $k = 2$ , KU (5, 3, -23) [4, 7]. (E25p1)

Solution 2. The additive (23) is pared by the divisor (3), KU (5, 3,  $\pm 2$ )  $[y', x]$  ( $y = y' \pm 7$ ). The mutual division is exactly the same as that of solution 1. Vall(1, 1, 2, 0)  $\gg$  Vall(4, 2). That is, KU (5, 3, 2) [4, 2]. By AR 3.1, KU (5, 3, -2) [1, 1]. By AR 4, KU (5, 3, 23) [11, 2] and KU (5, 3, -23) [-6, 1]. By adding (5, 3) twice to the latter, KU (5, 3, -23) [4, 7]. (E25p2)

Solution 3. Both the dividend (5) and the additive (23) are pared by the divisor (3), KU (2, 3,  $\pm 2$ )  $[y', x]$  ( $y = y' + x \pm 7$ ). PB  $\begin{bmatrix} 2 & 3 & 2 & 1 \\ & 0 & 1 & \end{bmatrix}$ . Vall(0, 1, 2, 0)  $\gg$  Vall(2, 2). That is, KU (2, 3, 2) [2, 2]. By AR 5, KU (5, 3, 23) [11, 2]. (By AR 3.1, KU (5, 3, -23) [-6, 1]. By adding (5, 3) twice, KU (5, 3, -23) [4, 7].) (E25p3)

**E26=L 255:** 1. KU (5, 13, 0)  $[y, x]$ . 2. KU (5, 13, 65)  $[y, x]$ .

1. Solution. By AR 6, KU (5, 13, 0) [0, 0].

2. Solution. By AR 6, KU (5, 13, 65) [5, 0]. By AR 7, KU (5, 13, 65) [10, 13] etc.

**36cd-37ab=L 257:** Constant kuṭṭaka.

If KU  $(a, b, \pm 1) [\beta, \alpha]$ , then KU  $(a, b, \pm c) [c\beta, c\alpha]$ . If  $c\beta > a$  and  $c\alpha > b$ , then they are pared by  $a$  and  $b$ , respectively. The word 'constant' (sthira) refers to the fact that the dividend  $a$  and the divisor  $b$  are kept constant while the additive  $c$  varies in this calculation.

In 37abp, Bhāskara illustrates this rule by solving E21: KU (221, 195, 65)  $[y, x]$ . As before, the equation is reduced by 13: KU (17, 15, 5)  $[y, x]$ . First solve KU (17, 15, 1)  $[y, x]$  as before: KU (17, 15, 1) [8, 7]. Then, by the rule of constant kuṭṭaka, KU (221, 195, 65) [6, 5].

From KU (17, 15, 1) [8, 7], by AR 3.1, KU (17, 15, -1) [9, 8]. By the above rule, KU (17, 15, -5) [11, 10]. (37abp ends here.)

**37cd-38=L 258:** Constant kuṭṭaka in planetary calculation (graha-gaṇita).

1. Revolutions of a planet and accumulated civil days. Let  $D$  be the number of

civil days in a Kalpa (an integer),  $R$  the number of revolutions of a planet in a Kalpa (an integer),  $d$  the number of accumulated civil days from the beginning of the Kalpa (an integer), and  $r$  the number of revolutions of the planet when  $d$  civil days have passed. Since  $D : R = d : r$ , we have  $r = \frac{Rd}{D}$ . Let the integer part of  $r$  be  $q_1$  and the remainder  $r_1$  (which is called the ‘residue of revolution’):  $\frac{Rd}{D} = q_1 + \frac{r_1}{D}$ . Now, the sub-units of the revolution are defined as follows: 1 revolution = 12 zodiacal signs, 1 sign = 30 degrees, 1 degree = 60 minutes, and 1 minute = 60 seconds. The ‘residue of revolution’ divided by  $D$  can be expressed in these sub-units (see the calculations in the left column in the next paragraph):  $q_2$  signs,  $q_3$  degrees,  $q_4$  minutes,  $q_5$  seconds, and the residue of second  $r_5$ . That is to say, when  $d$  civil days have passed since the beginning of the Kalpa, the planet made  $q_1$  complete revolutions and is located at  $q_3$  degrees,  $q_4$  minutes,  $q_5$  seconds, and the residue of second  $r_5$  in the  $(q_2 + 1)$ -th sign.

If the ‘residue of second’  $r_5$  is given, we can obtain, in order,  $q_5$ ,  $q_4$ ,  $q_3$ ,  $q_2$ ,  $q_1$ , and  $d$  by solving the five indeterminate equations in the right column from the bottom upward. As the quotient and multiplier  $(y, x)$  of an equation having the subtractive  $r_i$  are  $(q_i, r_{i-1})$ , the multiplier obtained of that equation shall be the subtractive of the next step.

$$\begin{array}{ll} \frac{R}{D} \times d = q_1 + \frac{r_1}{D} & y = \frac{Rx - r_1}{D} \\ \frac{r_1}{D} \times 12 = q_2 + \frac{r_2}{D} & y = \frac{12x - r_2}{D} \\ \frac{r_2}{D} \times 30 = q_3 + \frac{r_3}{D} & y = \frac{30x - r_3}{D} \\ \frac{r_3}{D} \times 60 = q_4 + \frac{r_4}{D} & y = \frac{60x - r_4}{D} \\ \frac{r_4}{D} \times 60 = q_5 + \frac{r_5}{D} & y = \frac{60x - r_5}{D} \end{array}$$

In these kuṭṭaka calculations, the dividends ( $R$ , 12, 30, and 60) and the divisor ( $D$ ) are constant while the remainders ( $r_i$ ’s) vary. Therefore, if one solves in advance  $KU(R, D, -1)[y, x]$ ,  $KU(12, D, -1)[y, x]$ ,  $KU(30, D, -1)[y, x]$ , and  $KU(60, D, -1)[y, x]$ , then one can easily solve  $KU(R, D, -r_1)[y, x]$  etc. by the rule of the constant kuṭṭaka (BG 36cd–37ab).

2. Intercalary months and solar days. Let  $D_s$  be the number of solar days in a Kalpa (an integer),  $A$  the number of intercalary months in a Kalpa (an integer),  $d_s$  the number of elapsed solar days (an integer), and  $a$  the number of elapsed intercalary months when  $d_s$  solar days have gone. Since  $D_s : A = d_s : a$ , we have  $a = \frac{Ad_s}{D_s}$ . Let the integer part of  $a$  be  $q_1$  and the remainder  $r_1$ :  $\frac{Ad_s}{D_s} = q_1 + \frac{r_1}{D_s}$ . If the ‘residue of intercalary month’  $r_1$  is given, the solutions  $(y, x)$  of the equation,



$y = \frac{Ax-r_1}{D_s}$ , are the number of the completed intercalary months and that of the past solar days ( $q_1, d_s$ ).

3. Omitted lunar days and lunar days. Let  $D_m$  be the number of lunar days in a Kalpa (an integer),  $U$  the number of omitted lunar days in a Kalpa (an integer),  $d_m$  the number of the past lunar days (an integer), and  $u$  = the number of the past omitted lunar days when  $d_m$  lunar days have gone. Since  $D_m : U = d_m : u$ , we have  $u = \frac{Ud_m}{D_m}$ . Let the integer part of  $u$  be  $q_1$  and the remainder  $r_1$ :  $\frac{Ud_m}{D_m} = q_1 + \frac{r_1}{D_m}$ . If the 'residue of omitted lunar day  $r_1$  is given, the solutions  $(y, x)$  of the equation,  $y = \frac{Ux-r_1}{D_m}$ , are the number of the completed omitted lunar days and that of the past lunar days ( $q_1, d_m$ ).

**39=L 259:** Contiguous kuṭṭaka.

This is applied to a system of simultaneous indeterminate equations of the type:

$$a_i x = bq_i + r_i \quad (0 \leq r_i < b; \quad i = 1, 2, \dots, n).$$

Rule. Let  $a = a_1 + a_2 + \dots + a_n$  and  $c = r_1 + r_2 + \dots + r_n$  and apply the kuṭṭaka procedure to KU  $(a, b, -c) [y, x]$ .

Note that  $a_i$  is called guṇa (multiplier) in the statements of problems but bhājya (dividend) in the kuṭṭaka procedure. Cf. GA, praśna 13–14 for 'sphuṭa-kuṭṭaka.'

**E27=L 260:**  $5x = 63q_1 + 7$ ,  $10x = 63q_2 + 14$ .

Solution. The two equations are combined:  $15x = 63(q_1 + q_2) + 21$ , which is equivalent to:  $q_1 + q_2 = (15x - 21)/63$ . The kuṭṭaka procedure is applied to KU  $(15, 63, -21) [y, x]$ . PB  $\begin{bmatrix} 15 & 63 & 15 & 3 & 0 \\ 0 & 4 & 5 \end{bmatrix}$ . Hence follows the reducer 3. The equation reduced by 3: KU  $(5, 21, -7) [y, x]$ . PB  $\begin{bmatrix} 5 & 21 & 5 & 1 \\ 0 & 4 \end{bmatrix}$ . Vall(0, 4, 7, 0) >> Vall(7, 28). By paring, (2, 7). That is, KU  $(5, 21, 7) [2, 7]$ . By AR 3.1, KU  $(5, 21, -7) [3, 14]$ . Therefore,  $x = 14$  is a solution.

### III.1.6 Chapter 6: Varga-prakṛti

#### Section 6.1: Varga-prakṛti

This chapter treats the indeterminate equation,  $px^2 + t = y^2$ . The coefficient  $p$  is called prakṛti (natural form) and the procedure for solution varga-prakṛti (natural form of square). I express the equation by VP  $(p) [x, y, t]$ ; VP  $(p) [\alpha, \beta, \gamma]$  means that  $(x, y, t) = (\alpha, \beta, \gamma)$  is a set of solutions of VP  $(p) [x, y, t]$ .

**40:** Rule 1. Trial method.

Given  $p$ , find out a set of solution VP  $(p) [\alpha, \beta, \gamma]$  by trial and error.

**41–43:** Rule 2. Generative method (bhāvanā).

Given two sets of solutions, VP  $(p) [\alpha_1, \beta_1, \gamma_1]$  and VP  $(p) [\alpha_2, \beta_2, \gamma_2]$ ,

$$\alpha_3 = | \alpha_1\beta_2 \pm \alpha_2\beta_1 |, \quad \beta_3 = | p\alpha_1\alpha_2 \pm \beta_1\beta_2 |, \quad \gamma_3 = \gamma_1\gamma_2$$

is another set of solutions of  $\text{VP}(p)[x, y, t]$ . This procedure is called *bhāvanā* or generative method. The *bhāvanā* with the plus sign is called the generative method by sum (*samāsa-bhāvanā*) and that with the negative sign the generative method by difference (*antara-bhāvanā*). When  $\alpha_1 = \alpha_2$ ,  $\beta_1 = \beta_2$ , and  $\gamma_1 = \gamma_2$ , it is called the generative method (by sum) with equals (*tulya-bhāvanā*). I express the procedure of the generative method by

$$\text{BH}^\pm(p) \begin{bmatrix} \alpha_1 & \beta_1 & \gamma_1 \\ \alpha_2 & \beta_2 & \gamma_2 \end{bmatrix} = \text{VP}(p) [\alpha_3, \beta_3, \gamma_3].$$

**44:** Rule 3. Reduction and multiplication.

Given  $\text{VP}(p) [\alpha, \beta, \gamma]$ , then  $\text{VP}(p) [\alpha/a, \beta/a, \gamma/a^2]$  and  $\text{VP}(p) [a\alpha, a\beta, a^2\gamma]$  for any optional  $a$ .

**45–46ab:** Rule 4. Rational solutions of  $\text{VP}(p)[x, y, 1]$ .

$\text{VP}(p) \left[ \frac{2a}{|p-a^2|}, \beta, 1 \right]$  for any optional  $a$ . ‘Infinite (sets of solutions can be obtained) by means of the generative method (rule 2) and by optionally chosen numbers.’

As for  $\beta$ , the verses simply say that ‘the greater (root should be calculated) from it.’ It may be expressed as:  $\beta = \frac{p+a^2}{|p-a^2|}$ .

**E28:** 1.  $\text{VP}(8)[x, y, 1]$ . 2.  $\text{VP}(11)[x, y, 1]$ .

1. Solution of  $\text{VP}(8)[x, y, 1]$ . By rule 1 (trial and error),  $\text{VP}(8)[1, 3, 1]$ . By rule 2 (generative method with equals),  $\text{BH}^+(8) \begin{bmatrix} 1 & 3 & 1 \\ 1 & 3 & 1 \end{bmatrix} = \text{VP}(8)[6, 17, 1]$ . By rule 2 (generative method by sum),  $\text{BH}^+(8) \begin{bmatrix} 1 & 3 & 1 \\ 6 & 17 & 1 \end{bmatrix} = \text{VP}(8)[35, 99, 1]$ . Likewise, infinite solutions of  $\text{VP}(8)[x, y, 1]$  can be obtained. (E28p1)

2. Solution of  $\text{VP}(11)[x, y, 1]$ . By rule 1,  $\text{VP}(11)[1, 3, -2]$ . By rule 2,  $\text{BH}^+(11) \begin{bmatrix} 1 & 3 & -2 \\ 1 & 3 & -2 \end{bmatrix} = \text{VP}(11)[6, 20, 4]$ . By rule 3,  $\text{VP}(11)[3, 10, 1]$ . By rule 2,  $\text{BH}^+(11) \begin{bmatrix} 3 & 10 & 1 \\ 3 & 10 & 1 \end{bmatrix} = \text{VP}(11)[60, 199, 1]$ . Likewise, infinite solutions of  $\text{VP}(11)[x, y, 1]$  can be obtained. (E28p2)

3. Another solution of  $\text{VP}(11)[x, y, 1]$ . By rule 1,  $\text{VP}(11)[1, 4, 5]$ . By rule 2,  $\text{BH}^+(11) \begin{bmatrix} 1 & 4 & 5 \\ 1 & 4 & 5 \end{bmatrix} = \text{VP}(11)[8, 27, 25]$ . By rule 3,  $\text{VP}(11) \left[ \frac{8}{5}, \frac{27}{5}, 1 \right]$ . By rule 2,  $\text{BH}^+(11) \begin{bmatrix} 8/5 & 27/5 & 1 \\ 3 & 10 & 1 \end{bmatrix} = \text{VP}(11) \left[ \frac{161}{5}, \frac{534}{5}, 1 \right]$ ; or, by difference,  $\text{BH}^-(11) \begin{bmatrix} 8/5 & 27/5 & 1 \\ 3 & 10 & 1 \end{bmatrix} = \text{VP}(11) \left[ \frac{1}{5}, \frac{6}{5}, 1 \right]$ . Likewise, may solutions of  $\text{VP}(11)[x, y, 1]$  can be obtained. (E28p3)

4. By means of rule 4. With  $a = 3$ , rule 4 brings the solutions,  $\text{VP}(8)[6, 17, 1]$  (cf. 1 above) and  $\text{VP}(11)[3, 10, 1]$  (cf. 2 above). Likewise, infinite solutions of both equations can be obtained by means of rule 4 with the optional number  $a$  or by means of the generative method (rule 2) with sum or difference from the already obtained solutions. (E28p4)

*Section 6.2: Cakravāla*

**46cd–50ab:** Rule 5. Cakravāla (cyclic) method for solving VP ( $p$ ) [ $x, y, 1$ ].

Given VP ( $p$ ) [ $\alpha_0, \beta_0, \gamma_0$ ], let KU ( $\alpha_0, \gamma_0, \beta_0$ ) [ $n, m$ ]. Then VP ( $p$ ) [ $\alpha_1, \beta_1, \gamma_1$ ], where

$$\alpha_1 = n, \quad \gamma_1 = \frac{m^2 - p}{\gamma_0}, \quad \beta_1 = \sqrt{p\alpha_1^2 + \gamma_1}.$$

If one repeats this procedure, choosing at each step such  $m$  that makes  $|m^2 - p|$  smallest, then one arrives at VP ( $p$ ) [ $\alpha_k, \beta_k, \gamma_k$ ] with  $\gamma_k = \pm 4, \pm 2$ , or  $\pm 1$ . For the cases other than  $\gamma_k = 1$ , apply rule 2 and/or rule 3 to obtain solutions of VP ( $p$ ) [ $x, y, 1$ ]. Hereafter I use the notation,  $g(m) = |m^2 - p|$ .

**E29:** 1. VP (67) [ $x, y, 1$ ]. 2. VP (61) [ $x, y, 1$ ].

1. Solution of VP (67) [ $x, y, 1$ ].

1.1. Since VP (67) [ $1, 8, -3$ ] by rule 1, KU ( $1, -3, 8$ ) [ $y, x$ ] is to be solved. Reverse the sign of the divisor: KU ( $1, 3, 8$ ) [ $y', x$ ]. Pare the additive by the divisor: KU ( $1, 3, 2$ ) [ $y'', x$ ]. Then, PB  $\begin{bmatrix} 1 & 3 & 1 \\ & & 0 \end{bmatrix}$  and Vall( $0, 2, 0$ )  $\gg$  Vall( $0, 2$ ). By AR 1, KU ( $1, 3, 2$ ) [ $1, 1$ ]. By AR 4, KU ( $1, 3, 8$ ) [ $3, 1$ ]. By SR 1.3, KU ( $1, -3, 8$ ) [ $-3, 1$ ]. By AR 7, KU ( $1, -3, 8$ ) [ $-3 + k, 1 - 3k$ ]. When  $k = -2$ , KU ( $1, -3, 8$ ) [ $-5, 7$ ] and  $g(7) = 18$  is the smallest. When  $m = 7$ ,  $\gamma_1 = (m^2 - p)/\gamma_0 = (7^2 - 67)/(-3) = 6$ ;  $\alpha_1 = n = -5$ , whose sign is reversed, 5; and  $\beta_1 = \sqrt{p\alpha_1^2 + \gamma_1} = 41$ . Hence follows VP (67) [ $5, 41, 6$ ]. (E29p1)

1.2. KU ( $5, 6, 41$ ) [ $y, x$ ] is to be solved. PB  $\begin{bmatrix} 5 & 6 & 5 & 1 \\ & & 0 & 1 \end{bmatrix}$ . Vall( $0, 1, 41, 0$ )  $\gg$  Vall( $41, 41$ ). By paring, ( $11, 5$ ), that is, KU ( $5, 6, 41$ ) [ $11, 5$ ]. By AR 7, KU ( $5, 6, 41$ ) [ $11 + 5k, 5 + 6k$ ]. When  $k = 0$ , KU ( $5, 6, 41$ ) [ $11, 5$ ] and  $g(5) = 42$  is the smallest. When  $m = 5$ ,  $\gamma_2 = (m^2 - p)/\gamma_1 = (5^2 - 67)/6 = -7$ ;  $\alpha_2 = n = 11$ ; and  $\beta_2 = \sqrt{p\alpha_2^2 + \gamma_2} = 90$ . Hence follows VP (67) [ $11, 90, -7$ ]. (E29p2)

1.3. KU ( $11, -7, 90$ ) [ $y, x$ ] is to be solved. Reverse the sign of the divisor: KU ( $11, 7, 90$ ) [ $y', x$ ]. Pare the additive by the divisor: KU ( $11, 7, 6$ ) [ $y'', x$ ]. Then, PB  $\begin{bmatrix} 11 & 7 & 4 & 3 & 1 \\ & & 1 & 1 & 1 \end{bmatrix}$  and Vall( $1, 1, 1, 6, 0$ )  $\gg$  Vall( $18, 12$ ). By paring, ( $7, 5$ ). By AR 1, KU ( $11, 7, 6$ ) [ $4, 2$ ], KU ( $11, 7, 90$ ) [ $16, 2$ ], and KU ( $11, -7, 90$ ) [ $-16, 2$ ]. By AR 7, KU ( $11, -7, 90$ ) [ $-16 + 11k, 2 - 7k$ ]. When  $k = -1$ , ( $y, x$ ) = ( $-27, 9$ ) and  $g(9) = 14$  is the smallest. When  $m = 9$ . Then,  $\gamma_3 = (m^2 - p)/\gamma_2 = (9^2 - 67)/(-7) = -2$ ;  $\alpha_3 = n = -27$ , whose sign is reversed, 27; and  $\beta_3 = \sqrt{p\alpha_3^2 + \gamma_3} = 221$ . Hence follows VP (67) [ $27, 221, -2$ ]. (E29p3)

1.4. By rule 2, BH<sup>+</sup>(67)  $\begin{bmatrix} 27 & 221 & -2 \\ 27 & 221 & -2 \end{bmatrix} =$  VP (67) [ $11934, 97684, 4$ ]. By rule 3, VP (67) [ $5967, 48842, 1$ ]. (E29p4)

2. Solution of VP (61) [ $x, y, 1$ ].

2.1. Since VP (61) [ $1, 8, 3$ ] by rule 1, KU ( $1, 3, 8$ ) [ $y, x$ ] is to be solved. Pare the additive by the divisor: KU ( $1, 3, 2$ ) [ $y', x$ ]. Then, Vall( $0, 2, 0$ )  $\gg$  Vall( $0, 2$ ). By AR 1, KU ( $1, 3, 2$ ) [ $1, 1$ ]. By AR 4, KU ( $1, 3, 8$ ) [ $3, 1$ ]. By AR 7, KU ( $1, 3, 8$ ) [ $3 + k, 1 + 3k$ ]. When  $k = 2$ , KU ( $1, 3, 8$ ) [ $5, 7$ ] and  $g(7) = 12$  is the smallest. When  $m = 7$ ,  $\gamma_1 =$

$(m^2 - p)/\gamma = (7^2 - 61)/3 = -4$ ;  $\alpha_1 = n = 5$ ; and  $\beta_1 = \sqrt{p\alpha_1^2 + \gamma_1} = 39$ . Hence follows VP (61) [5, 39, -4]. (E29p5)

2.2. By rule 3, VP (61) [5/2, 39/2, -1]. By rule 2,

$$\text{BH}^+(61) \begin{bmatrix} 5/2 & 39/2 & -1 \\ 5/2 & 39/2 & -1 \end{bmatrix} = \text{VP} (61) \left[ \frac{195}{2}, \frac{1523}{2}, 1 \right]. \quad (\text{E29p6})$$

2.3. By rule 2,

$$\text{BH}^+(61) \begin{bmatrix} 195/2 & 1523/2 & 1 \\ 5/2 & 39/2 & -1 \end{bmatrix} = \text{VP} (61) [3805, 29718, -1].$$

By rule 2,

$$\text{BH}^+(61) \begin{bmatrix} 3805 & 29718 & -1 \\ 3805 & 29718 & -1 \end{bmatrix} = \text{VP} (61) [226153980, 1766319049, 1]. \quad (\text{E29p7})$$

**50cd–52ab:** Rule 6. Solubility of VP ( $p$ ) [ $x, y, -1$ ].

1. If  $p$  is not the sum of two square numbers, then VP ( $p$ ) [ $x, y, -1$ ] does not have a solution.

2. If  $p$  is the sum of two square numbers, say  $a^2$  and  $b^2$ , then VP ( $p$ ) [ $1/a, \beta, -1$ ] and VP ( $p$ ) [ $1/b, \beta, -1$ ], where  $\beta = \sqrt{p(1/a)^2 - 1} = b/a$  and  $\beta = \sqrt{p(1/b)^2 - 1} = a/b$ , respectively; or, otherwise VP ( $p$ ) [ $x, y, -1$ ] may be solved by rule 1 (trial and error).

**E30:** 1. VP (13) [ $x, y, -1$ ]. 2. VP (8) [ $x, y, -1$ ].

1. Solution of VP (13) [ $x, y, -1$ ].

1.1. As  $13 = 2^2 + 3^2$ , by rule 6.2, VP (13) [ $\frac{1}{2}, \frac{3}{2}, -1$ ] and VP (13) [ $\frac{1}{3}, \frac{2}{3}, -1$ ]. (E30p1)

1.2. Or, otherwise, by rule 1, VP (13) [1, 3, -4]. By rule 3, VP (13) [ $\frac{1}{2}, \frac{3}{2}, -1$ ]. Likewise, by rule 1, VP (13) [1, 2, -9]. By rule 3, VP (13) [ $\frac{1}{3}, \frac{2}{3}, -1$ ]. (E30p2)

1.3. For integer solutions, the cyclic method is used. Since VP (13) [ $\frac{1}{2}, \frac{3}{2}, -1$ ] from above, KU ( $\frac{1}{2}, -1, \frac{3}{2}$ ) [ $y, x$ ] is to be solved. By ‘reducing’ (apavartya) the dividend and the divisor by the common factor  $\frac{1}{2}$ , KU (1, -2, 3) [ $y, x$ ]. Reverse the sign of the divisor: KU (1, 2, 3) [ $y', x$ ]. Pare the additive by the divisor: KU (1, 2, 1) [ $y'', x$ ]. Then, Vall(0, 1, 0) >> Vall(0, 1). By AR 1, KU (1, 2, 1) [1, 1], KU (1, 2, 3) [2, 1], and KU (1, -2, 3) [-2, 1]. By AR 7, KU (1, -2, 3) [-2 +  $k$ , 1 - 2 $k$ ]. When  $k = 0$ , KU (1, -2, 3) [-2, 1] and  $g(1) = 12$ , which is not the least. When  $k = -1$ ,  $x = 3$  and  $g(3) = 4$ , which is the least. When  $m = 3$ ,  $\gamma_1 = (m^2 - p)/\gamma_0 = (9 - 13)/(-1) = 4$ ;  $\alpha_1 = n = -3$ , whose sign is reversed, 3; and  $\beta_1 = \sqrt{13 \times 3^2 + 4} = 11$ . Hence follows VP (13) [3, 11, 4]. Now, KU (3, 4, 11) [ $y, x$ ] is to be solved. Vall(0, 1, 11, 0) >> Vall(11, 11). By paring, KU (3, 4, 11) [5, 3]. By AR 7, KU (3, 4, 11) [5 + 3 $k$ , 3 + 4 $k$ ]. When  $k = 0$ ,  $x = 3$  and  $g(3) = 4$ , which is the smallest. When  $m = 3$ ,  $\gamma_2 =$

$(m^2 - p)/\gamma_1 = (9 - 13)/4 = -1$ ;  $\alpha_2 = n = 5$ ; and  $\beta_2 = \sqrt{13 \times 5^2 - 1} = 18$ . Hence follows VP (13) [5, 18, -1]. This is a set of integer solutions for ‘ $t = -1$ ’. Infinite solutions of VP (13) [x, y, -1] can be obtained from this set with a set of integer solutions for ‘+1’, which can be obtained by rule 2:

$$\text{BH}^+(13) \begin{bmatrix} 5 & 18 & -1 \\ 5 & 18 & -1 \end{bmatrix} = \text{VP} (13) [180, 649, 1]. \text{ (E30p3)}$$

2. Solution of VP (8) [x, y, -1]. As  $8 = 2^2 + 2^2$ , by rule 6.2, VP (8)  $\left[\frac{1}{2}, 1, -1\right]$ . (E30p4)

**E31:** 1. VP (6) [x, y, 3]. 2. VP (6) [x, y, 12]. 3. VP (6) [x, y, 75]. 4. VP (6) [x, y, 300].

Solution. By rule 1, VP (6) [1, 3, 3]. From this, by rule 3 with  $a = 2$ , VP (6) [2, 6, 12]; with  $a = 5$ , VP (6) [5, 15, 75]; and with  $a = 10$ , VP (6) [10, 30, 300].

**52cd–53ab:** Rule 7. Infinite solutions of VP ( $p$ ) [x, y,  $\gamma$ ].

Once a set of solutions for  $t = \gamma$ , VP ( $p$ ) [ $\alpha, \beta, \gamma$ ], and a set of solutions for  $t = 1$ , VP ( $p$ ) [ $\alpha_0, \beta_0, 1$ ], are obtained somehow by one’s own intelligence, then infinite sets of solutions of VP ( $p$ ) [x, y,  $\gamma$ ] can be obtained by rule 2 (bhāvanā).

The introduction (52cdp0) says that this rule was intended to show the calculation of roots (solutions) for additive unity but it does not precisely agree with the given rule, although that case is also included as a special case ( $\gamma = 1$ ).

**53cd:** Rule 8. A set of solutions of VP ( $p$ ) [x, y,  $t$ ] when  $p$  is divisible by a square number.

If  $p/a^2 = p'$  and VP ( $p'$ ) [ $\alpha, \beta, \gamma$ ], then VP ( $p$ ) [ $\alpha/a, \beta, \gamma$ ].

**E32:** VP (32) [x, y, 1].

Solution 1. By rule 1, VP (32)  $\left[\frac{1}{2}, 3, 1\right]$ .

Solution 2. VP (8) [1, 3, 1] by rule 1, and  $32 = 8 \times 2^2$ . Hence, by rule 8, follows VP (32)  $\left[\frac{1}{2}, 3, 1\right]$ .

**54:** Rule 9. A set of solutions of VP ( $p$ ) [x, y,  $t$ ] when  $p$  is a square number.

If  $p = a^2$ , then for any two numbers,  $m$  and  $n$  ( $\neq 0$ ),

$$\text{VP} (p) \left[ \left( \frac{n}{m} - m \right) \div 2 \div a, \left( \frac{n}{m} + m \right) \div 2, n \right].$$

**E33:** 1. VP (9) [x, y, 52]. 2. VP (4) [x, y, 33].

1. Solution of VP (9) [x, y, 52]. By rule 9 with  $m = 2$ , VP (9) [4, 14, 52]; with  $m = 4$ , VP (9)  $\left[3/2, 17/2, 52\right]$ .

2. Solution of VP (4) [x, y, 33]. By rule 9 with  $m = 1$ , VP (4) [8, 17, 33]; with  $m = 3$ , VP (4) [2, 7, 33].

**E34:** 1. VP (13)  $[x, y, -13]$ . 2. VP (13)  $[x, y, 13]$ .

1. Solution of VP (13)  $[x, y, -13]$ . By rule 1, VP (13)  $[1, 0, -13]$ . By rule 4, VP (13)  $\left[\frac{3}{2}, \frac{11}{2}, 1\right]$ . From this, by rule 2,

$$\text{BH}^+(13) \begin{bmatrix} 1 & 0 & -13 \\ 3/2 & 11/2 & 1 \end{bmatrix} = \text{VP} (13) \left[ \frac{11}{2}, \frac{39}{2}, -13 \right].$$

2. Solution of VP (13)  $[x, y, 13]$ . From VP (13)  $\left[\frac{1}{2}, \frac{3}{2}, -1\right]$  (cf. E30) and from VP (13)  $[1, 0, -13]$  and VP (13)  $\left[\frac{11}{2}, \frac{39}{2}, -13\right]$  (cf. 1 above), by rule 2,

$$\text{BH}^\pm(13) \begin{bmatrix} 1 & 0 & -13 \\ 1/2 & 3/2 & -1 \end{bmatrix} = \text{VP} (13) \left[ \frac{3}{2}, \frac{13}{2}, 13 \right],$$

$$\text{BH}^+(13) \begin{bmatrix} 11/2 & 39/2 & -13 \\ 1/2 & 3/2 & -1 \end{bmatrix} = \text{VP} (13) [18, 65, 13],$$

$$\text{BH}^-(13) \begin{bmatrix} 11/2 & 39/2 & -13 \\ 1/2 & 3/2 & -1 \end{bmatrix} = \text{VP} (13) \left[ \frac{3}{2}, \frac{13}{2}, 13 \right].$$

**E35:** VP  $(-5) [x, y, 21]$ .

Solution. By rule 1, VP  $(-5) [1, 4, 21]$  and VP  $(-5) [2, 1, 21]$ . Also by rule 1, VP  $(-5) [1, 2, 9]$ . By rule 3 with  $a = \frac{1}{3}$ , VP  $(-5) \left[\frac{1}{3}, \frac{2}{3}, 1\right]$ . From this and the first solution, VP  $(-5) [1, 4, 21]$ , by rule 2,

$$\text{BH}^+(-5) \begin{bmatrix} 1 & 4 & 21 \\ 1/3 & 2/3 & 1 \end{bmatrix} = \text{VP} (-5) [2, 1, 21],$$

which is nothing but the second solution. Also by rule 2 (by difference),

$$\text{BH}^-(-5) \begin{bmatrix} 1 & 4 & 21 \\ 1/3 & 2/3 & 1 \end{bmatrix} = \text{VP} (-5) \left[ -\frac{2}{3}, -\frac{13}{3}, 21 \right].$$

Reverse the sign of  $x$  and  $y$ : VP  $(-5) \left[\frac{2}{3}, \frac{13}{3}, 21\right]$ . Also from VP  $(-5) \left[\frac{1}{3}, \frac{2}{3}, 1\right]$  and VP  $(-5) [2, 1, 21]$  by rule 2,

$$\text{BH}^+(-5) \begin{bmatrix} 2 & 1 & 21 \\ 1/3 & 2/3 & 1 \end{bmatrix} = \text{VP} (-5) \left[ \frac{5}{3}, -\frac{8}{3}, 21 \right].$$

Reverse the sign of  $y$ : VP  $(-5) \left[\frac{5}{3}, \frac{8}{3}, 21\right]$ . Also by rule 2 (by difference),

$$\text{BH}^-(-5) \begin{bmatrix} 2 & 1 & 21 \\ 1/3 & 2/3 & 1 \end{bmatrix} = \text{VP} (-5) [1, -4, 21].$$

Reverse the sign of  $y$ : VP  $(-5) [1, 4, 21]$ , which is the same as the first solution. Likewise, by rule 2 (bhāvanā) with VP  $(-5) \left[\frac{1}{3}, \frac{2}{3}, 1\right]$ , a number of solutions of VP  $(-5) [x, y, 21]$  can be obtained.

**55:** Concluding remark of the first six chapters.

According to Bhāskara, what have been told in Chapters 1 to 6 are preliminaries to the main topics of the bīja-gaṇita, which he deals with in Chapters 7 to 11.

## III.1.7 Chapter 7: Equations in one color

Hereafter, when I express the ‘statements of problem,’ I use the symbols according to the following principle:  $x$  with or without subscripts,  $y$ , and  $z$  for the unknown numbers whose values are to be obtained,  $a$ ,  $b$ ,  $c$ , and  $p$  for known numbers,  $q$  and  $r$  with or without subscripts for both known and unknown numbers (esp. for unknown quotients and remainders of divisions), and the rest ( $u$ ,  $v$ , etc. with or without subscripts) for the unknown numbers whose values are not required in the problem.

**56–58:** Rule for the first seed, one-color equation.

1. Assuming the value (māna) of the unknown quantity (avyakta-rāśi) to be yāvattāvat, make two sides (pakṣas) equal to each other according to the statements of the problem (uddiṣṭa). [samī-karaṇa, ‘making equal’ or equation]

2. Subtract the unknown of one side from the other side (strictly speaking, from both sides) and the rūpas of that side from the first side (strictly speaking, from both sides). [sama-śodhana, ‘subtracting equal things’ or equal subtraction]

3. Divide the remaining rūpas by the remaining unknown, and the manifest (vyakta) value of the unknown quantity is produced.

4. If there is more than one unknown quantity in the problem, assume them, except one, to be a multiple of yāvattāvat or its fractional part, or the same increased or decreased by some quantity, or even a known quantity.

In 58p1, Bhāskara gives definitions of the ‘quartet of seeds’ (bīja-catuṣṭaya): ‘The first seed is the equation in one color; the second seed is the equation in more than one color; (the third is) the elimination of the second term where equations of the square etc. of one, two, or more colors occur; (the fourth is) bhāvita where equations of bhāvita occur.’ For bhāvita see 8cd–9 above.

**E36–37:** Properties of two persons in horses and money.

$x$  = price of a horse,  $u_i$  = properties of two persons ( $i = 1, 2$ ).

Statements of problem 1.  $6x + 300 = u_1$ ,  $10x - 100 = u_2$ , and  $u_1 = u_2$ .

Solution. Let  $x = s$  ( $= yā 1$ ). Then,  $6s + 300 (= u_1 = u_2) = 10s - 100$ . Subtract  $6s$  and  $-100$  from both sides:  $400 = 4s$ . Divide the remaining rūpas 400 by the remaining unknown 4:  $s = 100$ . Raised by this,  $x = 100$  and  $u_1 = u_2 = 900$ . (E37p1)

Statements of problem 2.  $u_i$  = same as above, and  $u_1/2 + 2 = u_2$ .

Solution.  $3s + 152 = 10s - 100$ ,  $7s = 252$ ,  $s = 36$ . Or, otherwise, since  $u_1 = (u_2 - 2) \times 2$ ,  $6s + 300 = \{(10s - 100) - 2\} \times 2 = 20s - 204$ ,  $14s = 504$ ,  $s = 36$ . Hence follow  $x = 36$ ,  $u_1 = 516$ , and  $u_2 = 260$ . (E37p2)

Statements of problem 3.  $u_i$  = same as above, and  $u_1 = 3u_2$ .

Solution.  $6s + 300 = 3(10s - 100)$ ,  $6s + 300 = 30s - 300$ ,  $24s = 600$ ,  $s = 25$ . When raised by this,  $x = 25$ ,  $u_1 = 450$ , and  $u_2 = 150$ . (E37p3)

**E38:** Properties of two persons in three kinds of gems and money.

$x_i$  = price of a piece of the  $i$ -th kind of gems ( $i = 1, 2, 3$ ),  $u_i$  = property of the  $i$ -th person ( $i = 1, 2$ ).

Statement of problem.  $5x_1 + 8x_2 + 7x_3 + 90 = u_1$ ,  $7x_1 + 9x_2 + 6x_3 + 62 = u_2$ , and  $u_1 = u_2$ .

Solution 1. Let  $x_1 = 3s$  (=  $y\bar{a}$  3),  $x_2 = 2s$  (=  $y\bar{a}$  2), and  $x_3 = 1s$  (=  $y\bar{a}$  1). Then,  $15s + 16s + 7s + 90 = 21s + 18s + 6s + 62$ ,  $38s + 90 = 45s + 62$ ,  $7s = 28$ ,  $s = 4$ . When raised by this,  $x_1 = 12$ ,  $x_2 = 8$ ,  $x_3 = 4$ , and  $u_1 = u_2 = 242$ . (E38p1)

Solution 2. Let  $x_1 = s$  (=  $y\bar{a}$  1),  $x_2 = 5$ , and  $x_3 = 3$ . Then,  $5s + 151 = 7s + 125$ ,  $2s = 26$ , and  $s = 13$ . When raised by this,  $x_1 = 13$ ,  $x_2 = 5$ ,  $x_3 = 3$ , and  $u_1 = u_2 = 216$ . (E38p2)

**E39:** Properties of two persons after mutual donation.

$x_i$  = properties of two persons ( $i = 1, 2$ ).

Statements of problem.  $x_1 + 100 = 2(x_2 - 100)$  and  $6(x_1 - 10) = x_2 + 10$ .

Solution. Let  $x_1 = 2s - 100$  and  $x_2 = s + 100$ . Then, the first statement ( $\bar{a}l\bar{a}pa$ ) is realized ( $gha\check{t}ate$ ) automatically. From the second statement,  $6\{(2s - 100) - 10\} = (s + 100) + 10$ ,  $12s - 660 = s + 110$ ,  $11s = 770$ ,  $s = 70$ . When raised by this,  $x_1 = 40$  and  $x_2 = 170$ .

**E40:** Purchase of three kinds of gems.

$x_i$  = price of the  $i$ -th kind of gems ( $i = 1, 2, 3$ ).

Statements of problem.  $8x_1 = u$ ,  $10x_2 = u$ ,  $100x_3 = u$ , and  $x_1 + x_2 + x_3 = 47$ .

Solution. Let  $u = s$  (=  $y\bar{a}$  1). Then,  $x_1 = s/8$ ,  $x_2 = s/10$ , and  $x_3 = s/100$ . Hence follows  $\frac{47}{200}s = 47$ . Reduce both sides to a common denominator:  $\frac{47}{200}s = \frac{9400}{200}$ . Eliminate the denominators:  $47s = 9400$ . Then,  $s = 9400 \div 47 = 200$ . When raised by this,  $x_1 = 25$ ,  $x_2 = 20$ ,  $x_3 = 2$ ,  $u = 200$ , and the total price of all the gems is  $3u = 600$ . (E40p1)

E40p2 gives the reason why the elimination of the denominators 200's is allowed. It is because the denominators disappear in the process of calculating  $s = \frac{9400}{200} \div \frac{47}{200} = \frac{9400}{200} \times \frac{200}{47}$  even if they were not eliminated at that step.

**E41=L 55:** A flock of bees.

$x$  = the number of bees.

Statement of problem.  $\frac{x}{5} + \frac{x}{3} + 3\left(\frac{x}{3} - \frac{x}{5}\right) + 1 = x$ .

Solution. Let  $x = s$  (=  $y\bar{a}$  1). Then,  $\frac{x}{5} + \frac{x}{3} + 3\left(\frac{x}{3} - \frac{x}{5}\right) = \frac{14}{15}s$ . Hence follows  $\frac{14}{15}s + 1 = s$ ,  $\frac{14}{15}s + \frac{15}{15} = \frac{15}{15}s$ ,  $14s + 15 = 15s$ ,  $s = 15$ . Raised by this,  $x = 15$ .

In the L, this problem is given as an example for the  $i\check{s}ta$ -karman or 'optional-quantity operation' (L 51).

**E42:** Equal amounts of interest on different capitals in equal periods.



$x_i$  = two capitals ( $i = 1, 2$ ),  $y$  = amounts of interest on the two capitals,  $z$  = periods of loan,  $r_i\%$  = interest rates ( $i = 1, 2$ ).

Statements of problem.  $y = 5x_1z/100$  ( $r_1 = 5$ ),  $x_2 = x_1 - y^2$ , and  $y = 10x_2z/100$  ( $r_2 = 10$ ).

Solution 1. Assume  $z = 5$  and let  $x_1 = s$  ( $= y\bar{a} 1$ ). Then, by the five-quantity operation (first statement),  $y = s/4$ . From the second statement,  $x_2 = s - (s/4)^2 = (-s^2 + 16s)/16$ . Again by the five-quantity operation (third statement),  $y = (-s^2 + 16s)/32$ . Hence follows the equation,  $(-s^2 + 16s)/32 = s/4$ . Reduced by  $s$ ,  $(-s + 16)/32 = 1/4$ . Reduce both sides to a common denominator and eliminate the denominators:  $-s + 16 = 8$ . By the equal-subtraction,  $s = 8$  or  $x_1 = 8$ . (Raised by this,  $x_2 = 4$  and  $y = 2$ .) (E42p1)

Easy method (algorithm without ‘colors’). From the first and the third statements,  $x_1 = (r_2/r_1) \cdot x_2 = 1 \cdot x_2 + (r_2/r_1 - 1)x_2$ . (This step of decomposition is not explicitly mentioned but hinted by the word ‘ekagaṇam’ which is otherwise useless.) From the second statement, on the other hand,  $x_1 = x_2 + y^2$ . Hence follows  $(r_2/r_1 - 1)x_2 = y^2$ , or,  $x_2 = y^2/(r_2/r_1 - 1)$ . (E42p2)

Solution 2 (by means of the algorithm given in E42p2).  $r_2/r_1 = 10/5 = 2$ . Assume  $y = 2$ . Then,  $x_2 = 2^2/(2 - 1) = 4$  and  $x_1 = 4 + 4 = 8$ . By the three-quantity operation,  $z = 1 \cdot 2/(5 \cdot 8/100) = 5$  months. (E42p3)

**E43:** Equal amounts of interest on different capitals in equal periods.

$x_i$  = two capitals ( $i = 1, 2$ ),  $y$  = amounts of interest on the two capitals,  $z$  = periods of loan,  $r_i\%$  = interest rates ( $i = 1, 2$ ).

Statements of problem.  $y = 1x_1z/100$  ( $r_1 = 1$ ),  $x_2 = x_1 - y^2$ , and  $y = 5x_2z/100$  ( $r_2 = 5$ ).

Solution (by means of the algorithm given in E42p2).  $r_2/r_1 = 5/1 = 5$ . Assume  $y = 4$ . Then,  $x_2 = y^2/(r_2/r_1 - 1) = 16/4 = 4$ ,  $x_1 = x_2 + y^2 = 4 + 16 = 20$ , and  $z = 1 \cdot 4/(1 \cdot 20/100) = 20$  months. (E43p1)

Kṛṣṇa points out that this example has been designed for showing the validity of the easiness of the ‘easy method’ given in E42p2. Cf. 97cd–98 below.

In E43p2, Bhāskara emphasizes the importance of the intellect (buddhi), citing the next verse from his *Golādhyaṅya*.

**Q2=GA praśna 5:** Importance of intellect for bīja-gaṇita.

‘Bīja(-gaṇita) is not just composed of colors (symbols employed for indicating unknown numbers). Nor are there different bījas (seeds) (even though there exists the traditional concept of bīja-catuṣṭaya (quartet of seeds)). There exists only one (true) bīja, that is, intelligence (matī), because the function of thought (kalpanā) is vast.’

For the relationships between the three concepts, seed, intelligence and color, see BG 73. For Bhāskara’s references to intellect or intelligence see matī, buddhi, and

dhī in Appendix 6 (Index to Words). For the concept of bīja-catuṣṭaya see BG 58p1.

**E44=L 102:** Exchanges of gems.

$x_i$  = price of a piece of the  $i$ -th kind of gems ( $i = 1, 2, 3, 4$ ).  $u_i$  = property of the  $i$ -th person ( $i = 1, 2, 3, 4$ ).

Statements of problem.  $(8-3)x_1+x_2+x_3+x_4 = u_1$ ,  $x_1+(10-3)x_2+x_3+x_4 = u_2$ ,  $x_1+x_2+(100-3)x_3+x_4 = u_3$ ,  $x_1+x_2+x_3+(5-3)x_4 = u_4$ , and  $u_1 = u_2 = u_3 = u_4$ .

Solution. Bhāskara uses the initial letter of the name of each kind of gems in order to indicate each price but I use  $x_i$  instead. Subtract  $x_1 + x_2 + x_3 + x_4$  from every side:  $4x_1 = 6x_2 = 96x_3 = x_4$ . Assume every side obtained to be 96. Then,  $x_1 = 96/4 = 24$ ,  $x_2 = 96/6 = 16$ ,  $x_3 = 96/96 = 1$ , and  $x_4 = 96/1 = 96$ .

In the L, this problem is given as an example for L 101, which prescribes an algorithm for a more general case including the present one.

**E45:** Loan.

$x$  = capital,  $u$  = interest.

Statements of problem.  $u = 5 \cdot 12 \cdot x/100$  and  $x + u = 2x - 16$ .

Solution. Let  $x = s$  (= yā 1). Then,  $u = \frac{3}{5}s$ . Hence follows  $\frac{8}{5}s = 2s - 16$ ,  $s = 40$ . When raised by this,  $x = 40$  and  $u = 24$ .

**E46:** Loan in three installments with equal totals.

$x_i$  = capitals,  $u_i$  = interests ( $i = 1, 2, 3$ ).

Statements of problem.  $x_1+x_2+x_3 = 390$ ,  $u_1 = (5 \cdot 7 \cdot x_1)/100$ ,  $u_2 = (2 \cdot 10 \cdot x_2)/100$ ,  $u_3 = (4 \cdot 5 \cdot x_3)/100$ , and  $x_i + u_i = v$  ( $i = 1, 2, 3$ ).

Solution. Let  $v = s$  (= yā 1). If  $x_1 = 100$ , then  $u_1 = 35$  and  $x_1 + u_1 = 135$ . Conversely, if  $x_1 + u_1 = 135$ , then  $x_1 = 100$ . Therefore, by proportion, if  $x_1 + u_1 = s$ , then  $x_1 = \frac{100}{135}s = \frac{20}{27}s$ . Likewise,  $x_2 = \frac{5}{3}s$  and  $x_3 = \frac{5}{3}s$ . Hence follows  $\frac{20}{27}s + \frac{5}{3}s + \frac{5}{3}s = 390$ ,  $\frac{65}{27}s = 390$ ,  $s = 162$ . Raised by this,  $x_1 = 120$ ,  $x_2 = x_3 = 135$ , and  $v = 162$ . (Raised by these,  $u_1 = 42$  and  $u_2 = u_3 = 27$ .)

**E47:** Property of a traveling merchant and tolls.

$x$  = original property of a merchant,  $u_i$  = his property at his departure from the  $i$ -th town ( $i = 1, 2, 3$ ).

Statements of problem.  $(x - 10) \times 2 - 10 - 10 = u_1$ ,  $(u_1 - 10) \times 2 - 10 - 10 = u_2$ ,  $(u_2 - 10) \times 2 - 10 - 10 = u_3$ , and  $u_3 = 3x$ .

Solution. Let  $x = s$  (= yā 1), then  $u_1 = 2s - 40$ ,  $u_2 = 4s - 120$ , and  $u_3 = 8s - 280$ . Therefore,  $8s - 280 = 3s$ ,  $5s = 280$ ,  $s = 56$ . Raised by this,  $x = 56$ .

**E48=L 99:** Purchase of two commodities in a given ratio.

$x_i$  = quantities of rice and kidney beans purchased,  $y_i$  = prices of rice and kidney beans purchased ( $i = 1, 2$ ).

Statements of problem.  $x_1 : x_2 = 2 : 1$ ,  $y_1 + y_2 = 13$  kākiṇīs (=  $\frac{13}{64}$  dramma),  $x_1/y_1 = 3\frac{1}{2}$  māna/dramma, and  $x_2/y_2 = 8$  māna/dramma.

Solution. Let  $x_2 = s$  ( $= yā 1$ ) māna. Then,  $x_1 = 2s$  māna. Since  $y_1 = \frac{4}{7}s$  dramma and  $y_2 = \frac{1}{8}s$  dramma,  $\frac{39}{56}s = \frac{13}{64}$ ,  $\frac{24}{448}s = \frac{7}{448}$ ,  $24s = 7$ ,  $s = \frac{7}{24}$ . Raised by this,  $x_1 = \frac{7}{12}$  māna,  $x_2 = \frac{7}{24}$  māna,  $y_1 = \frac{1}{6}$  dramma, and  $y_2 = \frac{7}{192}$  dramma.

In L 98, Bhāskara prescribes an algorithm for solving this type of problems.

**E49:** Additions and subtractions of parts (purely numerical).

Statements of problem.  $x_1 + \frac{x_1}{2} = x_2 + \frac{x_2}{5} = x_3 + \frac{x_3}{9}$  and  $x_1 - \frac{x_2}{5} - \frac{x_3}{9} = x_2 - \frac{x_1}{2} - \frac{x_3}{9} = x_3 - \frac{x_1}{2} - \frac{x_2}{5} = 60$ .

Solution. Let  $x_1 + \frac{x_1}{2} = \dots = s$  ( $= yā 1$ ). By the rule of inverse operations (L 48–49),  $x_1 = \frac{2}{3}s$ ,  $x_2 = \frac{5}{6}s$ , and  $x_3 = \frac{9}{10}s$ . Therefore,  $x_1 - \frac{x_2}{5} - \frac{x_3}{9} = \dots = \frac{2}{5}s$ . Hence follows  $\frac{2}{5}s = 60$ ,  $s = 150$ . Raised by this,  $x_1 = 100$ ,  $x_2 = 125$ , and  $x_3 = 135$ .

In this problem, the number of the equations exceeds that of the unknown quantities.

**E50:** Base of a trilateral.

$a, b$  = two flank sides of a trilateral,  $A$  = area,  $x$  = base. This is the terminology of E50 but Bhāskara regards the side  $a$  as the base of the trilateral, using the following terminology:  $u_1, u_2$  = segments of the base  $a$  touching the flank sides  $b$  and  $x$ , respectively, and  $v$  = perpendicular to the base  $a$ .

Statements of problem.  $\langle v^2 + u_1^2 = b^2, v^2 + u_2^2 = x^2, u_1 + u_2 = a, A = \frac{a}{2} \cdot v \rangle$ ,  $a = ka 13$  ( $= \sqrt{13}$ ),  $b = ka 5$  ( $= \sqrt{5}$ ), and  $A = 4$ ,

Solution. By the rule of L 166,  $A = \frac{a}{2} \cdot v$ . Conversely,  $v = A/\frac{a}{2}$ . Therefore,  $v^2 = A^2/(a^2/4) = 16/(13/4) = 64/13$ ,  $v = ka 64/13$ . By the Pythagorean theorem,  $u_1 = \sqrt{b^2 - v^2} = \sqrt{5 - 64/13} = \sqrt{1/13} = ka \frac{1}{13}$ .  $u_2 = a - u_1 = ka 13 - ka \frac{1}{13} = ka \frac{144}{13}$  (according to BG 12). Therefore,  $x^2 = v^2 + u_2^2 = 64/13 + 144/13 = 16$ , from which follows  $x = 4$ .

Note that the symbol  $yā$  is not used in this solution. The trilateral presupposed in this solution consists of the two right-angled triangles,  $(1, 2, \sqrt{5})$  and  $(2, 3, \sqrt{13})$ .

Kṛṣṇa rightly makes a bi-quadratic equation for this problem and obtains the two solutions,  $s^2 = 20$  and  $s^2 = 16$  but rejects the former. He says, ‘Here, the former should not be accepted because it is not proved’ (atrādyam anupapannatvān na grāhyam).

**E51:** Perpendicular of a trilateral.

$a$  = base of a trilateral,  $b, c$  = two flank sides,  $u_1, u_2$  = segments of the base  $a$  touching  $c$  and  $b$ , respectively,  $x$  = perpendicular.

Statements of problem.  $\langle x^2 + u_1^2 = c^2, x^2 + u_2^2 = b^2, u_1 + u_2 = a \rangle$ ,  $a = r\ddot{u} 1 ka 18$  ( $= -1 + \sqrt{18}$ ),  $b = ka 6$  ( $= \sqrt{6}$ ), and  $c = ka 5 ka 10$  ( $= -\sqrt{5} + \sqrt{10}$ ),

Solution. Let  $u_1 = s$  ( $yā 1$ ). Then,  $x^2 = c^2 - u_1^2 = (-\sqrt{5} + \sqrt{10})^2 - s^2 = -s^2 + 15 - \sqrt{200}$ ,  $u_2 = a - u_1 = -s - 1 + \sqrt{18}$ , and  $x^2 = b^2 - u_2^2 = (\sqrt{6})^2 - (-s - 1 + \sqrt{18})^2 =$

$-s^2 - 2s + \sqrt{72}s - 13 + \sqrt{72}$ . Hence follows the equation,

$$-s^2 + 15 - \sqrt{200} = -s^2 - 2s + \sqrt{72}s - 13 + \sqrt{72}.$$

By the equal subtraction etc.,

$$2s - \sqrt{72}s = -28 + \sqrt{512}.$$

By means of the division by rationalization of the divisor (BG 16–17),

$$\begin{aligned} s &= \frac{-28 + \sqrt{512}}{2 - \sqrt{72}} = \frac{-\sqrt{784} + \sqrt{512}}{\sqrt{4} - \sqrt{72}} = \frac{(-\sqrt{784} + \sqrt{512})(\sqrt{4} + \sqrt{72})}{(\sqrt{4} - \sqrt{72})(\sqrt{4} + \sqrt{72})} \\ &= \frac{\sqrt{36864} - \sqrt{3136} - \sqrt{56448} + \sqrt{2048}}{-68} = \frac{136 - \sqrt{36992}}{-68} = -2 + \sqrt{8}. \end{aligned}$$

Raised by this,  $u_1 = -2 + \sqrt{8}$  and  $u_2 = 1 + \sqrt{2}$ . Then, raise the  $s$  in  $x^2 = -s^2 - 2s + \sqrt{72}s - 13 + \sqrt{72}$  by this value of  $s$ , or use the relationships,  $x^2 = c^2 - u_1^2 = b^2 - u_2^2$ :  $x^2 = 3 - \sqrt{8}$ . Hence follows  $x = \sqrt{3 - \sqrt{8}} = -1 + \sqrt{2}$ .

For the root-extraction from a composite karanī, see BG 19–20 and 21.

**E52:** A quadratic and a cubic equations in four unknown numbers each.

Statements of problems. 1.  $\sum_{i=1}^4 x_i = \sum_{i=1}^4 x_i^2$ . 2.  $\sum_{i=1}^4 x_i^2 = \sum_{i=1}^4 x_i^3$ .

Solution of 1. Let  $x_i = is$  ( $= y\bar{a} i$ ). Then,  $\sum_{i=1}^4 x_i = 10s$  and  $\sum_{i=1}^4 x_i^2 = 30s^2$ . Hence follows  $10s = 30s^2$ . Reduced by  $s$ ,  $10 = 30s$ ,  $s = 1/3$ . Raised by this,  $x_i = i/3$ .

Solution of 2. Assume  $x_i = is$  ( $= y\bar{a} i$ ). Then,  $\sum_{i=1}^4 x_i^2 = 30s^2$  and  $\sum_{i=1}^4 x_i^3 = 100s^3$ . Hence follows  $30s^2 = 100s^3$ . Reduced by  $s^2$ ,  $30 = 100s$ ,  $s = 3/10$ . Raised by this,  $x_i = 3i/10$ .

**E53:** Three sides of a right-angled triangle.

$x, y, z =$  three sides of a right triangle.

Statements of problems.

1.  $\langle x^2 + y^2 = z^2 \text{ and } xy/2 = z \rangle$ .
2.  $\langle x^2 + y^2 = z^2 \text{ and } xy/2 = xyz \rangle$ .

Solution of problem 1. Assume  $x = 3s$  ( $= y\bar{a} 3$ ),  $y = 4s$  ( $= y\bar{a} 4$ ), and  $z = 5s$  ( $= y\bar{a} 5$ ). Then, the first statement is realized and  $6s^2 = 5s$ . Reduced by  $s$ ,  $6s = 5$ ,  $s = 5/6$ . Raised by this,  $x = 5/2$ ,  $y = 10/3$ , and  $z = 25/6$ . (E53p1)

Solution of problem 2. Assume exactly the same as above. Then, the first statement is realized and  $6s^2 = 60s^3$ . Reduced by  $s^2$ ,  $6 = 60s$ ,  $s = 1/10$ . Raised by this,  $x = 3/10$ ,  $y = 2/5$ , and  $z = 1/2$ . (E53p2)

These solutions utilize the right-angled triangle (3, 4, 5).

**E54:** A system of cubic equations in two main and three auxiliary unknown numbers.

Statements of problem.  $x + y = u^2$ ,  $x - y = v^2$ , and  $xy = w^3$ .

Solution. Let  $x = 5s^2$  (= yāvava 5) and  $y = 4s^2$  (= yāvava 4). Then, the first two statements are realized ( $u = 3s$ ,  $v = s$ ). Let  $w = 10s$ . Then,  $20s^4 = 1000s^3$ . Reduced by  $s^3$ ,  $20s = 1000$ ,  $s = 50$ . Raised by this,  $y = 10000$  and  $x = 12500$ .

**E55:** A system of cubic equations in two main and two auxiliary unknown numbers.

Statements of problem.  $x^3 + y^3 = u^2$  and  $x^2 + y^2 = v^3$ .

Solution. Let  $x = s^2$  (= yāva 1) and  $y = 2s^2$  (= yāva 2). Then, the first statement is realized ( $u = 3s^3$ ). (E55p1)

Objection: Why is  $9(s^2)^3$  (=  $x^3 + y^3$ ) a square number?

Answer: Because  $(s^2)^3 = (s^3)^2$ . In general,  $a^{2i}$  is a square number and its square-root is  $a^i$ ; and  $a^{3i}$  is a cube number and its cube-root is  $a^i$ . [Note that ‘the  $i$ -th power’ is indicated by the expression ‘ $i$ -gata’ ( $i$  is a cardinal number).] (E55p2)

Let  $v = 5s$ . Then,  $5(s^2)^2 = (5s)^3$ . Reduced by  $s^3$ ,  $5s = 125$ ,  $s = 25$ . Raised by this,  $x = 625$  and  $y = 1250$ . (E55p3)

Bhāskara remarks at the end of E55p3: ‘One should think about such ⟨assumptions⟩ that will make it possible to reduce ⟨both sides⟩ by the unknown numbers.’

**E56:** Perpendicular of a trilateral.

$a$ ,  $b$ ,  $c$  = base and flank sides of a trilateral,  $u_1$ ,  $u_2$  = segments of the base  $a$  touching  $c$  and  $b$ , respectively,  $x$  = perpendicular to the base.

Statements of problem. ⟨ $x^2 + u_1^2 = c^2$ ,  $x^2 + u_2^2 = b^2$ ,  $u_1 + u_2 = a$ ⟩,  $a = 14$ ,  $b = 15$ , and  $c = 13$ .

Solution. Let  $u_1 = s$  (= yā 1). Then,  $u_2 = -s + 14$ ,  $c^2 - u_1^2 = x^2 = b^2 - u_2^2$ , and  $-s^2 + 169 = -s^2 + 28s + 29$ . By the equal subtraction etc.,  $140 = 28s$ ,  $s = 5$ . Raised by this,  $u_1 = 5$  and  $u_2 = 9$ . Hence follows  $x^2 = 144$ ,  $x = 12$ .

The trilateral treated in this problem is the so-called Heron’s triangle, which consists of the two right-angled triangles, (5, 12, 13) and (9, 12, 15).

**E57=L 150:** A broken bamboo on the ground.

$a$  = height or total length of a broken bamboo,  $b$  = distance between its foot and its tip touching the ground,  $x$ ,  $u$  = lower and upper portions of the broken bamboo.

Statements of problem. ⟨ $x^2 + b^2 = u^2$ ⟩,  $x + u = a$ ,  $a = 32$  hastas, and  $b = 16$  hastas.

Solution. Let  $x = s$  (= yā 1). Then,  $u = -s + 32$  and  $s^2 + 16^2 = (-s + 32)^2$  or  $s^2 + 256 = s^2 - 64s + 1024$ . By the equal subtraction etc.,  $s = 12$ . Raised by this,  $x = 12$  and  $u = 20$ .

This problem utilizes the right-angled triangle (12, 16, 20) or (3, 4, 5). In L 149, Bhāskara prescribes an algorithm for solving this type of problems.

**E58=L 155:** A leaning lotus in a pond.

$a$  = height of the flower bud of a lotus in a pond,  $b$  = distance between the point on the water surface where the lower end of the bud originally touched and the point where the upper end of the leaning lotus touches,  $x$  = depth of the water or the length of the stalk of the lotus,  $u$  = total length of the lotus.

Statements of problem.  $\langle x^2 + b^2 = u^2 \rangle$ ,  $u = x + a$ ,  $a = 1$  vitasti ( $= \frac{1}{2}$  hasta), and  $b = 2$  hastas.

Solution. Let  $x = s$  ( $= y\bar{a} 1$ ). Then,  $s^2 + 2^2 = (s + \frac{1}{2})^2$  or  $s^2 + 4 = s^2 + s + \frac{1}{4}$ . By the equal subtraction etc.,  $s = \frac{15}{4}$ . Raised by this,  $x = \frac{15}{4}$  and  $u = \frac{17}{4}$ .

This problem utilizes the right-angled triangle (2, 15/4, 17/4) or (8, 15, 17). In L 153, Bhāskara gives an algorithm for solving this type of problems and, in L 154, explains how to apply that algorithm to this particular problem.

**E59=L 157:** Equal journeys of two monkeys.

$a$  = height of a tree,  $b$  = distance between a pond and the foot of the tree,  $x$  = jump of a monkey,  $u$  = length of the diagonal rout.

Statements of problem.  $\langle (x + a)^2 + b^2 = u^2 \rangle$ ,  $x + u = a + b$ ,  $a = 100$  hastas, and  $b = 200$  hastas.

Solution. Let  $x = s$  ( $= y\bar{a} 1$ ). Then,  $(s + 100)^2 + 200^2 = (300 - s)^2$  or  $s^2 + 200s + 10000 + 40000 = 90000 - 600s + s^2$ . By the equal subtraction etc.,  $s = 50$ . Raised by this,  $x = 50$ .

This problem utilizes the right-angled triangle (150, 200, 250) or (3, 4, 5). In L 156, Bhāskara prescribes an algorithm for solving this type of problems.

**E60=L 162:** Perpendicular thread in between two pieces of bamboo.

$a$ ,  $b$  = heights of two pieces of bamboo ( $a > b$ ),  $x$  = perpendicular from the intersection of the two threads stretched from the tip of one bamboo to the foot of the other,  $u$  = distance between the two bamboos,  $u_1$ ,  $u_2$  = segments of  $u$  divided by the perpendicular and touching  $a$  and  $b$ , respectively.

Statements of problem.  $u_1 + u_2 = u$ ,  $\langle a : u = x : u_2, b : u = x : u_1 \rangle$ ,  $a = 15$  hastas, and  $b = 10$  hastas.

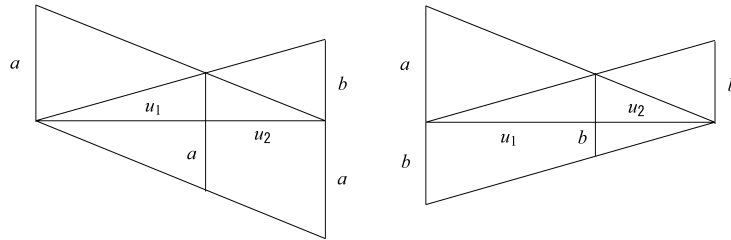
Solution 1. Assume  $u = 20$  hastas. Let  $x = s$  ( $= y\bar{a} 1$ ). Then,  $a : u = s : u_2$  and  $b : u = s : u_1$ , from which  $u_1 = 2s$  and  $u_2 = \frac{4}{3}s$  are obtained. Hence follows the equation,  $2s + \frac{4}{3}s = 20$ , or  $s = 6$ . Raised by this,  $x = 6$ ,  $u_1 = 12$ , and  $u_2 = 8$ . (E60p1)

Solution 2 (without using the bījas). Assume  $u = 20$ . From the three-quantity operations,  $(a + b) : (u_1 + u_2) = a : u_1$  and  $(a + b) : (u_1 + u_2) = b : u_2$ ,  $u_1 = 12$  and  $u_2 = 8$  are obtained. By proportion,  $u : a = u_2 : x$  and  $u : b = u_1 : x$ . From either

one,  $x = 6$ . (E60p2)

Solution 3 (by an algorithm).  $x = ab/(a + b) = 15 \cdot 10/(15 + 10) = 6$ . (E60p3)

Solutions 1 and 2 utilize the right-angled triangles, (15, 20, 25) or (3, 4, 5) and (10, 20,  $\sqrt{500}$ ) or (1, 2,  $\sqrt{5}$ ). The three-quantity operations used in solution 2 were presumably obtained geometrically by lengthening the bamboos  $b$  and  $a$  respectively by  $a$  and  $b$  downwards (see the figures below). At the end of E60p3, Bhāskara points out that solution 3 shows that the value of  $x$  does not depend on the distance  $u$  between the two bamboos, and says, ‘One should understand this by stretching threads on the ground.’ The algorithm used in solution 3 was presumably obtained algebraically from the three relationships,  $u_1 + u_2 = u$ ,  $a : u = x : u_2$ , and  $b : u = x : u_1$ . He verifies the algorithm in the former half of L 161; in the latter half of the same verse, he gives an algorithm for obtaining the two segments ( $u_1, u_2$ ).



III.1.8 Chapter 8: Elimination of the middle term of (equations in) one color

**59–61:** Rule for the second seed, elimination of the middle term.

0. According to the first two steps of the rule for the first seed (BG 56–58), make two sides (pakṣas) equal to each other (samī- $\sqrt{kṛ}$ ), reduce every term in the equation to a common denominator (sama-cchedī- $\sqrt{kṛ}$ ) if the equation includes a fraction or fractions, eliminate the denominators (cheda-gama), and subtract the same terms from both sides (sama-śodhana) so that one side may consist exclusively of an unknown quantity (side of unknown) and the other side of rūpas (side of known). If the side of unknown does not include the square or higher power of the unknown quantity, then apply step 3 of the rule for the first seed. [This step is understood.]

1. If the side of unknown includes the square or higher power of an unknown quantity, then make that side a square number by multiplying both sides by an appropriate number and adding another appropriate number to both sides.

2. Make a new equation from the square-roots of both sides (madhyama-āharaṇa) and apply the first seed (steps 2 and 3).

3. If the side of unknown includes the cube, the square of square, etc. of an unknown quantity, step 1 may not be applicable. In that case, use one’s own intelligence (sva-buddhi). See E67.

4. If the square-root of the side of known is smaller than the negative rūpas in the square-root of the side of unknown, then the value of the unknown should be obtained by making the square-root of the side of known both negative and positive. In that case, two values of the unknown are obtained. See E68. But it is not always the case. Even if the above condition is satisfied, if the result makes an element of the statements of problem negative, it should not be accepted. See E69, E70.

The procedure for a quadratic equation is as follows.

**Step 0:** Make two equal sides, separating known and unknown numbers.

$$Ax^2 + Bx = C.$$

**Step 1:** Make the side of unknown a square number. Then, the side of known must also become a square number; otherwise, the problem is wrong:

$$(1) a^2x^2 + 2abx + b^2 = c^2 \quad \text{or} \quad (2) a^2x^2 - 2abx + b^2 = c^2,$$

where  $a, b, c$  are positive numbers.

**Step 2:** From (1) follow (1a)  $ax + b = c$  and (1b)  $ax + b = -c$ . Likewise, from (2) follow (2a)  $ax - b = c$  and (2b)  $ax - b = -c$ . Through this step the middle term ( $2abx$ ) is eliminated (madhyama-āharāṇa).

**Seed 1:** From (1a) follows  $x = (-b + c)/a$ . From (1b) follows  $x = (-b - c)/a$  but the result, a negative number, is rejected. From (2a) follows  $x = (b + c)/a$ . From (2b) follows  $x = (b - c)/a$ , when  $b > c$ . Step 4 refers to this last case. Bhāskara does not give a condition for  $b$  and  $c$  in (1a).

**Q3:** Śrīdhara's method for calculating the root (mūla-upāya).

Multiply both sides of  $Ax^2 + Bx = C$  by  $4A$ ,

$$4A^2x^2 + 4ABx = 4AC,$$

and add  $B^2$  to both sides,

$$4A^2x^2 + 4ABx + B^2 = 4AC + B^2.$$

Take the square-roots of both sides,

$$2Ax + B = \pm\sqrt{4AC + B^2}.$$

The AM version of Śrīdhara's verse refers to the last step but the GT(K)P(K) version does not.

Sūryadāsa's algorithm cited by himself in his comment on Śrīdhara's verse (see the footnote on Q3) directly produces both sides of the last equation:



‘Twice ⟨the coefficient of⟩ the square of the unknown (2A) is put as ⟨a new coefficient of⟩ the unknown. When one has assumed it (i.e., the original coefficient of the unknown, B) as a rūpa, the other ⟨side of the equation⟩ (C) is multiplied by ⟨the new coefficient of⟩ the color (2A) and by two and increased by the square of the ⟨new⟩ rūpa ( $B^2$ ); its root is the “root” ⟨of the side of known⟩ in this case.’

**E61=L 71:** A flock of bees.

$x$  = number of the bees.

Statement of problem.  $\sqrt{x/2} + 8 \cdot (x/9) + 2 = x$ .

Solution. Let  $x = 2s^2$  (= yāva 2). Then,  $\sqrt{x/2} = s$ ,  $8 \cdot (x/9) = (16/9)s^2$ , and  $s + (16/9)s^2 + 2 = 2s^2$ . Reduce all terms to a common denominator and eliminate the denominators:  $18s^2 = 16s^2 + 9s + 18$ . By the equal subtraction,  $2s^2 - 9s = 18$ . Multiply both sides by 8 and add  $9^2$  to them:  $16s^2 - 72s + 81 = 225$ . Take the square-roots of both sides:  $4s - 9 = 15$ . Hence follows  $s = 6$ . Raised by this,  $x = 72$ .

In the L, this problem is given as an example for the algorithm of the ‘multiplier operation’ (L 65–66) and, in order to apply that algorithm, the statement is rewritten as  $(1/2)\sqrt{x/2} + (8/9)(x/2) + 1 = x/2$  in the prose part of L 71. For the ‘multiplier’ see under the next example.

**E62=L 70:** Arrows shot by Arjuna against Kārṇa.

$x$  = number of the arrows shot by Arjuna.

Statement of problem.  $x/2 + 4\sqrt{x} + 6 + 3 + 1 = x$ .

Solution. Let  $x = s^2$  (= yāva 1). Then,  $s^2/2 + 4s + 10 = s^2$ . ⟨By means of the reduction to a common denominator, elimination of the denominators, and equal subtraction,  $s^2 - 8s = 20$ . Add  $4^2$  to both sides:  $s^2 - 8s + 16 = 36$ . Take the square-roots of both sides:  $s - 4 = 6$ . Hence follows⟩  $s = 10$ . Raised by this,  $x = 100$ .

In the L, this problem is also given as an example for the algorithm of the ‘multiplier operation’ (L 65–66), where the ‘multiplier’ indicates that of the square-root that appears in the statement of problem (4 in the present example). For the story of Kārṇa-vadha see *Mahābhārata*, Poona ed., 8.67.

**E63:** An arithmetical progression.

$x, y, z, u$  = the first term, increase (common difference), number of terms, and the sum of an arithmetical progression.

Statements of problem.  $(z - 1)/2 = x$ ,  $x/2 = y$ ,  $xyz + xyz/7 = u$ , ⟨and  $u = \frac{z}{2} \{2x + y(z - 1)\}$ ⟩.

Solution. Let  $z = 4s + 1$  (= yā 4 rū 1). Then,  $x = 2s$  and  $y = s$ . Therefore,  $u = 2s \cdot s \cdot (4s + 1) + \{2s \cdot s \cdot (4s + 1)\}/7 = (64/7)s^3 + (16/7)s^2$ . On the other hand, according to the algorithm for the sum of an arithmetical progression (L 121),

$u = 8s^3 + 10s^2 + 2s$ . Equate the latter  $u$  to the former  $u$ :  $(64/7)s^3 + (16/7)s^2 = 8s^3 + 10s^2 + 2s$ . By means of the reduction by  $s$ , reduction to a common denominator, elimination of the denominators, and equal subtraction,  $8s^2 - 54s = 14$ . Multiplied by 8 and increased by  $27^2$ ,  $64s^2 - 54s + 729 = 841$ . Take the square-roots of both sides:  $8s - 27 = 29$ . Hence follows  $s = 7$ . Raised by this,  $x = 14$ ,  $y = 7$ ,  $z = 29$ , (and  $u = 3248$ ).

**E64:** A quantity affected by zero (purely numerical).

Statement of problem. There are three versions.

$$\text{AM: } \left\{ \left( \frac{x}{0} + x - 9 \right)^2 + \sqrt{\left( \frac{x}{0} + x - 9 \right)^2} \right\} \times 0 = 90.$$

$$\text{T: } \left\{ \left( \frac{x}{0} \pm x \right)^2 + \sqrt{\left( \frac{x}{0} \pm x \right)^2} \right\} \times 0 = 90.$$

$$\text{GP: } \left\{ \left( \frac{x}{0} \pm 10^7 \right)^2 + \sqrt{\left( \frac{x}{0} \pm 10^7 \right)^2} \right\} \times 0 = 90.$$

Solution of the AM version. Let  $x = s$  ( $= y\bar{a} 1$ ). Then,  $s \div 0 = (1/0)s$  ('zero-divisor'). 'That this is a zero-divisor is only assumed (in mind)' (*asya khaharatvaṃ kalpitam eva*).  $(1/0)s + s = 2s$ .  $(2s - 9)^2 + (2s - 9) = 4s^2 - 34s + 72$ . This is to be multiplied by zero. But previously zero was a divisor and now it is a multiplier. Therefore, both zero's are canceled according to L 46ab. The result is equal to 90:  $4s^2 - 34s + 72 = 90$ . By the equal subtraction,  $4s^2 - 34s = 18$ . Multiplied by 16 and increased by  $34^2$ ,  $64s^2 - 544s + 1156 = 1444$ . Take the square-roots of both sides:  $8s - 34 = 38$ . Hence follows  $s = 9$ . Raised by this,  $x = 9$ . (E64p1)

Solution of the T version. Let  $x = s$  ( $= y\bar{a} 1$ ). Then,  $s \div 0 = s/0$  ('zero-divisor');  $s/0 \pm s = s/0 \pm (s \cdot 0)/0 = (s \pm s \cdot 0)/0 = (s \pm 0)/0 = s/0$ ;  $(s/0)^2 = s^2/0^2 = s^2/0$ ;  $\sqrt{s^2/0} = \sqrt{s^2}/\sqrt{0} = s/0$ ;  $s^2/0 + s/0 = (s^2 + s)/0$ ;  $\{(s^2 + s)/0\} \times 0 = s^2 + s$ . This is equal to 90:  $s^2 + s = 90$ . Multiplied by 4 and increased by 1,  $4s^2 + 4s + 1 = 361$ . Take the square-roots of both sides:  $2s + 1 = 19$ . Hence follows  $s = 9$ . Raised by this,  $x = 9$ . (E64p2)

Solution of the GP version. Let  $x = s$  ( $= y\bar{a} 1$ ). Then,  $s \div 0 = (1/0)s$  ('zero-divisor');  $(1/0)s \pm 10^7 = (1/0)s$ ;  $\{(1/0)s\}^2 = (1/0)s^2$ ;  $\{(1/0)s^2 + (1/0)s\} \times 0 = s^2 + s$ . This is equal to 90:  $s^2 + s = 90$ . The rest of the solution is exactly the same as the second solution. (E64p3)

Sūryadāsa deals with the same equation as AM and his solution is the same as that of E64p1 (see the footnote for E64 in the Text). E64p1 and Sūryadāsa treat *kha-hara* ('zero-divisor') in a manner which does not agree with the nature of *kha-hara* alluded to by the simile in BG 6, according to which ' $s/0 + s$ ' (or ' $(1/0)s + s$ ') must be equal to ' $s/0$ ' (or ' $(1/0)s$ ') as in E64p2.

**E65:** A quantity affected by zero (purely numerical).

Statement of problem.

$$\left[ \left\{ \left( x + \frac{x}{2} \right) \times 0 \right\}^2 + 2 \times \sqrt{\left\{ \left( x + \frac{x}{2} \right) \times 0 \right\}^2} \right] \div 0 = 15.$$

Solution. Let  $x = s$  ( $= yā 1$ ). Then,  $s + s/2 = (3/2)s$ . Multiplied by zero,  $(3/2)s \times 0 = (3/2)s$ . Remember that this is a ‘zero-multiplier’ quantity. Squared,  $(9/4)s^2$  (zero-multiplier); increased by twice its own square-root,  $(9/4)s^2 + 3s = (9s^2 + 12s)/4$  (zero-multiplier). This is to be divided by zero. But this zero (divisor) and the previous zero (multiplier) are canceled. The result is equal to 15:  $(9s^2 + 12s)/4 = 15$ . By means of the reduction to a common denominator and elimination of the denominators,  $9s^2 + 12s = 60$ . Increased by 4,  $9s^2 + 12s + 4 = 64$ . Take the square-roots of both sides:  $3s + 2 = 8$ . Hence follows  $s = 2$ . Raised by this,  $x = 2$ .

Bhāskara’s treatment of zero in this solution may be explained as follows.  $\{(3/2)s \cdot 0\}^2 = (9/4)s^2 \cdot 0^2 = (9/4)s^2 \cdot 0 \cdot 2\sqrt{(9/4)s^2 \cdot 0} = 2 \cdot (\sqrt{9}/\sqrt{4})\sqrt{s^2} \cdot \sqrt{0} = 2 \cdot (3/2)s \cdot 0 = 3s \cdot 0 \cdot (9/4)s^2 \cdot 0 + 3s \cdot 0 = (9s^2 \cdot 0 + 12s \cdot 0)/4 = (9s^2 + 12s) \cdot 0/4 = \{(9s^2 + 12s)/4\} \cdot 0 \cdot \{(9s^2 + 12s)/4\} \cdot 0 \div 0 = (9s^2 + 12s)/4$ .

**Q4–5=L 45cd–46:** Rules for zero.

$\langle 0 + a = a, 0^2 = 0, 0^3 = 0, \sqrt{0} = 0, \sqrt[3]{0} = 0 \rangle$ ;  $a \div 0 = \frac{a}{0}$  (zero-divisor);  $a \times 0 = 0$  in general, but  $a \times 0 = a \cdot 0$  (zero-multiplier) if calculation remains, and  $(a \cdot 0) \div 0 = a$ ;  $\langle a + 0 = a, a - 0 = a \rangle$ .

**E66:** A cubic equation in one unknown number.

Statement of problem.  $12x + x^3 = 6x^2 + 35$ .

Solution. Let  $x = s$  ( $= yā 1$ ). Then,  $s^3 + 12s = 6s^2 + 35$ . By the equal subtraction,  $s^3 - 6s^2 + 12s = 35$ . Add  $-8$  to both sides:  $s^3 - 6s^2 + 12s - 8 = 27$ . Take the cube roots of both sides:  $s - 2 = 3$ . Hence follows  $s = 5$ . Raised by this,  $x = 5$ .

**E67:** A bi-quadratic equation in one unknown number.

Statement of problem.  $(x^2)^2 - (200x + x^2) \times 2 = 10^4 - 1$ .

Solution. Let  $x = s$  ( $= yā 1$ ). Then,  $s^4 - 2s^2 - 400s = 9999$ . When increased by  $(400s + 1)$ , the first side,  $s^4 - 2s^2 + 1$ , ‘gives a square-root’ ( $s^2 - 1$ ), but the second side does not. At this point, ‘one’s own intelligence’ (sva-buddhi) plays an important role (see item 3 of the rule in BG 59–61). When increased by  $(4s^2 + 400s + 1)$ ,  $s^4 + 2s^2 + 1 = 4s^2 + 400s + 10000$ . Take the square-roots of both sides:  $s^2 + 1 = 2s + 100$ . (By the equal subtraction,  $s^2 - 2s = 99$ . Increased by 1,  $s^2 - 2s + 1 = 100$ . Take the square-roots of both sides:  $s - 1 = 10$ .) Hence follows  $s = 11$ . Raised by this,  $x = 11$ .

**E68:** A troop of monkeys.

$x =$  number of monkeys.

Statement of problem.  $(x/8)^2 + 12 = x$ .

Solution. let  $x = s$  ( $= yā$  1). Then,  $(s^2 + 768)/64 = s$ . By the reduction to a common denominator, the elimination of the denominators, and the equal subtraction,  $s^2 - 64s = -768$ . Increased by  $32^2$ ,  $s^2 - 64s + 1024 = 256$ . Taking the square-roots of both sides,  $s - 32 = \pm 16$ . (For the two roots see item 4 of the rule in BG 59–61.) From  $s - 32 = 16$  follows  $s = 48$ . Raised by this,  $x = 48$ . From  $s - 32 = -16$  follows  $s = 16$ . Raised by this,  $x = 16$ .

**E69:** A troop of monkeys.

$x$  = number of monkeys.

Statement of problem.  $(x/5 - 3)^2 + 1 = x$ .

Solution. Let  $x = s$ . Then,  $x/5 - 3 = \frac{s-15}{5}$ . Squared,  $\left(\frac{s-15}{5}\right)^2 = \frac{s^2-30s+225}{25}$ . Increased by 1,  $\frac{s^2-30s+225}{25} + 1 = \frac{s^2-30s+250}{25}$ , which is equal to  $s$ :  $\frac{s^2-30s+250}{25} = s$ . By the reduction to a common denominator,  $\frac{s^2-30s+250}{25} = \frac{25s}{25}$ . By the elimination of the denominators,  $s^2 - 30s + 250 = 25s$ . By the equal subtraction,  $s^2 - 55s = -250$ . Multiplied by 4 and increased by  $55^2$ ,  $4 \times (s^2 - 55s) + 55^2 = 4 \times (-250) + 55^2$ , or  $4s^2 - 220s + 3025 = 2025$ . Take the square-roots of both sides:  $2s - 55 = \pm 45$ . From  $2s - 55 = 45$  follows  $s = 50$ . Raised by this,  $x = 50$ . From  $2s - 55 = -45$  follows  $s = 5$ . But this ‘should not be taken here because it is not appropriate, for people do not have a conviction concerning negative known number.’ By the ‘negative known number’ Bhāskara evidently refers to the element,  $x/5 - 3$ , of the statement which turns out to be negative when  $x = 5$ .

**E70:** Peg (gnomon), shadow, and ear (hypotenuse).

$x$  = shadow,  $u$  = ear or hypotenuse (distance between the tips of the peg and the shadow),  $a$  = peg or gnomon.

Statements of problem.  $x - u/3 = 14$ ,  $\langle x^2 + a^2 = u^2 \rangle$ , and  $a = 12$  angulas.

Solution. Let  $x = s$ . Then,  $s - 14 = u/3$ . Multiplied by 3,  $3s - 42 = u$ . Squared,  $9s^2 - 252s + 1764 = u^2$ . On the other hand,  $u^2 = x^2 + a^2 = s^2 + 144$ . Therefore,  $9s^2 - 252s + 1764 = s^2 + 144$ . By the equal subtraction,  $8s^2 - 252s = -1620$ . Multiplied by 2 and increased by  $(-63)^2$ ,  $16s^2 - 504s + 3969 = 729$ . Take the square-roots of both sides:  $4s - 63 = \pm 27$ . From  $4s - 63 = 27$  follows  $s = 45/2$ . Raised by this,  $x = 45/2$ . From  $4s - 63 = -27$  follows  $s = 9$ . But this should not be taken because it is inappropriate; for it makes  $u = 3(x - 14) < 0$ .

**Q6:** Padmanābha’s meta-rule for two solutions of a quadratic equation.

‘If the square-root of the side of known is smaller than the negative rūpas in the other side, then the value  $\langle$ of the unknown  $\rangle$  is produced twice by making the former root both positive and negative.’

Bhāskara points out that E70 is an anomaly to this meta-rule of Padmanābha. Item 4 of Bhāskara’s rule (BG 59–61) deals with the same case but it also makes

provision for the case the two-root rule should not be applied.

**E71–72:** A system of quadratic equations in four main and seven auxiliary unknown numbers.

$p$  = additive to quantity (rāṣi-kṣepa),  $q$  = additive to product (vadha-kṣepa).

Statements of problem.  $x_i + p = u_i^2$  ( $i = 1, 2, 3, 4$ ),  $x_i x_{i+1} + q = u_{i+4}^2$  ( $i = 1, 2, 3$ ),  $\sum_{i=1}^7 u_i + a = b^2$ ,  $a = 11$ ,  $b = 13$ ,  $p = 2$ , and  $q = 18$ .

Solution. If  $q = p(u_{i+1} - u_i)^2$  ( $i = 1, 2, 3$ ), then  $x_i x_{i+1} + q = (u_i u_{i+1} - p)^2$ . Therefore, if one determines  $u_1, \dots, u_4$  such that  $u_{i+1} = u_i + \sqrt{q/p}$  ( $i = 1, 2, 3$ ), then  $u_{i+4} = u_i u_{i+1} - p$  ( $i = 1, 2, 3$ ). Since  $p = 2$  and  $q = 18$  in the present example, put  $u_{i+1} = u_i + 3$  ( $i = 1, 2, 3$ ), and let  $u_1 = s$  (= yā 1). Then,  $u_2 = s + 3$ ,  $u_3 = s + 6$ ,  $u_4 = s + 9$ ,  $u_5 = s^2 + 3s - 2$ ,  $u_6 = s^2 + 9s + 16$ , and  $u_7 = s^2 + 15s + 52$ . Hence follows  $3s^2 + 31s + 84 = 13^2 - 11$ , or  $3s^2 + 31s = 74$ . Multiplied by 12 and increased by  $31^2$ ,  $36s^2 + 372s + 961 = 1849$ . Take the square-roots of both sides:  $6s + 31 = 43$ . Hence follows  $s = 2$ . Raised by this,  $u_1 = 2$ ,  $u_2 = 5$ ,  $u_3 = 8$ , and  $u_4 = 11$ ; and, therefore,  $x_1 = 2$ ,  $x_2 = 23$ ,  $x_3 = 62$ , and  $x_4 = 119$ .

**Q7:** A meta rule by predecessors for the same type of problem.

Determine  $u_1, \dots, u_4$  such that  $u_{i+1} = u_i + \sqrt{q/p}$  ( $i = 1, 2, 3$ ). Then,  $x_i = u_i^2 - p$ .

**E73:** Ear or hypotenuse of a right-angled triangle and ‘proof of that popular calculation’ of the hypotenuse (based on the so-called Pythagorean theorem).

$a, b, x$  = arm (side), edge (upright) and ear (hypotenuse) of a right-angled triangle,  $u_1, u_2$  = segments of the base  $x$  touching  $a$  and  $b$ , respectively,  $v$  = perpendicular to the base  $x$ .

Statements of problem.  $\langle u_1 + u_2 = x, x : a = a : u_1, x : b = b : u_2 \rangle$ , and  $a = 15$ ,  $b = 20$ . The value of  $x$  as well as a proof of the algorithm,  $x = \sqrt{a^2 + b^2}$ , should be told.

Solution 1. Let  $x = s$  (yā 1). Then, by the conformity (anurūpa) of the arms and the edges of the largest and the smallest right-angled triangles (see the figure in E73p1),  $s : 15 = 15 : u_1$ , from which follows  $u_1 = \frac{15^2}{s}$ . Likewise,  $s : 20 = 20 : u_2$ , from which follows  $u_2 = \frac{20^2}{s}$ . From  $s = u_1 + u_2$  (it follows that  $s = \frac{15^2}{s} + \frac{20^2}{s}$ ). Reduced to a common denominator,  $\frac{s^2}{s} = \frac{15^2}{s} + \frac{20^2}{s}$ . The denominators being eliminated,  $s^2 = 15^2 + 20^2 = 625$ . Take the square-roots of both sides):  $s = 25$ . Raised by this,  $x = 25$ ,  $u_1 = 9$ , and  $u_2 = 16$ . From these follows  $v = 12$  (which is not essential to this problem). In the course of this solution, the algorithm,  $x = \sqrt{a^2 + b^2}$ , was proved by  $s^2 = 15^2 + 20^2$ .

Solution 2. Make a large square consisting of four of the right-angled triangle  $(a, b, x)$  with a small square, whose side is equal to the difference  $|a - b|$ , at its center (see the figure in E73p2). Since the side of the large square is the ear ( $x$ ) of the right-angled triangle,  $s^2 = (20 - 15)^2 + 2 \times (15 \times 20) = 625$ . Hence follows

$s = 25$ . In the course of this solution, the relationship,

$$x^2 = |a - b|^2 + 2ab,$$

was proved by  $s^2 = (20 - 15)^2 + 2 \times (15 \times 20)$ . This relationship, combined with the identity given in the next verse (BG 62), proves the algorithm,  $x = \sqrt{a^2 + b^2}$ .

This problem utilizes two right-angled triangles both similar to (3, 4, 5).

**62:** An identity.

Using the same notation as in E73,

$$|a - b|^2 + 2ab = a^2 + b^2.$$

This identity holds true for the arm and the edge of a right-angled triangle as well as for any two unknown quantities.

Bhāskara points out in the prose part (62p) that this identity can be proved geometrically by rearranging the five parts of the large square constructed in solution 2 of E73 (see the figure in 62p).

From the relationship proved in solution 2 of E73 and the relationship proved here follows the relationship,  $x^2 = a^2 + b^2$ , from which follows  $x = \sqrt{a^2 + b^2}$ .

**E74:** Three sides of a right-angled triangle.

$x$ ,  $y$ ,  $z$  = arm (side), edge (upright) and ear (hypotenuse) of a right-angled triangle.

Statements of problem.  $\langle x^2 + y^2 = z^2$  and  $\rangle \sqrt{x - 3} - 1 = z - y$ .

Solution. Let  $z - y = 2$ . Then, by the inverse operation (L 48–50),  $\sqrt{x - 3} = 2 + 1 = 3$ ,  $x - 3 = 3^2 = 9$ , or  $x = 12$ . Hence follows  $z^2 - y^2 = x^2 = 144$ . On the other hand,  $z^2 - y^2 = (z + y)(z - y)$ . Therefore,  $z + y = 144/2 = 72$ . By the rule of concurrence (saṃkramaṇa, L 56),  $z = 37$  and  $y = 35$ . The solution in this case is  $(x, y, z) = (12, 35, 37)$ . Likewise, if  $z - y = 1$ , then (7, 24, 25); if  $z - y = 3$ , then (19, 176/3, 185/3); if  $z - y = 4$ , then (28, 96, 100); etc.

In the course of this solution, Bhāskara demonstrates the identity,  $z^2 - y^2 = (z + y)(z - y)$ , by rearranging the unit squares (koṣṭhaka) when  $z = 7$  and  $y = 5$  (see the three figures in E74p).

Note that none of the ‘four seeds’ is employed in this solution.

**63:** An identity.

When  $a$  and  $b$  are any two quantities,

$$(a + b)^2 - (a^2 + b^2) = 2ab.$$

In 63p, Bhāskara demonstrates this identity both numerically and geometrically by taking  $a = 3$  and  $b = 5$  (see the four figures in 63p).

**64:** An identity.

When  $a$  and  $b$  are any two quantities,

$$(a + b)^2 - 4ab = |a - b|^2.$$

In 64p, Bhāskara demonstrates this identity geometrically by taking  $a = 3$  and  $b = 5$  (see the figure in 64p).

**E75:** Three sides of a right-angled triangle.

$x$ ,  $y$ ,  $z$  = arm (side), edge (upright) and ear (hypotenuse) of a right-angled triangle.

Statements of problem.  $\langle x^2 + y^2 = z^2 \rangle$ ,  $x + y + z = 40$ , and  $xy = 120$ .

Solution. According to BG 63,  $2xy = (x + y)^2 - (x^2 + y^2) = (x + y)^2 - z^2 = (x + y + z)(x + y - z)$ , from which follows  $x + y - z = 2xy/(x + y + z) = 240/40 = 6$ . By the rule of concurrence (L 56),  $x + y = 23$  and  $z = 17$ . According to BG 64,  $(x - y)^2 = (x + y)^2 - 4xy = 49$ , from which follows  $x - y = 7$  (assuming  $x > y$ ). By the rule of concurrence (L 56),  $x = 15$  and  $y = 8$ .

Note that none of the ‘four seeds’ is employed in this solution.

**E76:** Three sides of a right-angled triangle.

$x$ ,  $y$ ,  $z$  = arm (side), edge (upright) and ear (hypotenuse) of a right-angled triangle.

Statements of problem.  $\langle x^2 + y^2 = z^2 \rangle$ ,  $x + y + z = 56$ , and  $xyz = 4200$ .

Solution. Let  $z = s$  (yā 1). Then,  $x^2 + y^2 = s^2$ ,  $x + y = -s + 56$ , and  $xy = xyz/z = \frac{4200}{s}$ . By the identity of BG 63 a one-color equation (ekavarṇa-samīkaraṇa) is obtained:  $(s^2 - 112s + 3136) - s^2 = \frac{8400}{s}$ , or  $-112s + 3136 = \frac{8400}{s}$ . Reduced to a common denominator,  $\frac{-112s^2 + 3136s}{s} = \frac{8400}{s}$ ; the denominators being eliminated,  $-112s^2 + 3136s = 8400$ ; divided by 112,  $-s^2 + 28s = 75$ ; multiplied by  $-1$ ,  $s^2 - 28s = -75$ ; increased by the square of half the coefficient of  $s$ ,  $s^2 - 28s + 196 = 121$ ; the square-roots of both sides being taken,  $s - 14 = \pm 11$ . Hence follow  $s = 25$  and  $s = 3$ . Out of these two,  $s = 3$  should not be taken because it is inappropriate (anupapanna). (For, if  $s = 3$ , then  $xy = 4200/3 = 1400$  and  $x + y = 56 - 3 = 53$ , and, by the identity of BG 64,  $|x - y|^2 = 53^2 - 4 \times 1400 = -2791$ .) When  $s = 25$ , on the other hand,  $xy = 4200/25 = 168$  and  $x + y = 56 - 25 = 31$ . From the identity of BG 64 follows  $|x - y|^2 = (x + y)^2 - 4xy = 31^2 - 4 \times 168 = 289$ , from which follows  $x - y = 17$  (or  $x - y = -17$  when  $x < y$ ). By the rule of concurrence (L 56),  $x = 24$  and  $y = 7$ . The solution is therefore  $(x, y, z) = (24, 7, 25)$  or  $(7, 24, 25)$ .

### III.1.9 Chapter 9: Equations in more than one color

Hereafter I use the notation, TR  $[a, b, c]$ , for indicating the algorithm of trairāśika: TR  $[a, b, c] = bc/a$ .

**65–68:** Rule for the third seed, multi-color equations.

1. Subtract one color (unknown) from one side of the equation and the other colors and rūpas from the other side. Divide the other side by the first side. The result is an evaluation of the first color.

2. If there is more than one evaluation for one color, then make those evaluations equated with each other and get evaluations of a second color. Repeat this procedure and apply kuṭṭaka to the last evaluation if only one color remains in its dividend. The multiplier and the quotient obtained by kuṭṭaka are the values of the two colors, one in the dividend and the other in the divisor, of the last evaluation.

3. If there is more than one color in the dividend of the last evaluation, then assume any optional quantities for them except one.

4. Raise the other colors one by one inversely by the values beginning with those of the two colors just obtained by kuṭṭaka.

5. If a fraction is obtained for some color in the course of the inverse operation of raising, then apply kuṭṭaka and once again raise the colors beginning with the last one inversely.

**Q8=E38:** Properties of two persons in three kinds of gems and money.

$x_i$  = price of a piece of the  $i$ -th kind of gems ( $i = 1, 2, 3$ ),  $u_i$  = property of the  $i$ -th person ( $i = 1, 2$ ).

Statements of problem.  $5x_1 + 8x_2 + 7x_3 + 90 = u_1$ ,  $7x_1 + 9x_2 + 6x_3 + 62 = u_2$ , and  $u_1 = u_2$ .

Solution. Let  $x_1 = s_1$  (yā 1),  $x_2 = s_2$  (kā 1), and  $x_3 = s_3$  (nī 1). Then,  $5s_1 + 8s_2 + 7s_3 + 90 = u_1 = u_2 = 7s_1 + 9s_2 + 6s_3 + 62$ , from which an evaluation of  $s_1$  is obtained:  $s_1 = \frac{-s_2 + s_3 + 28}{2}$ . This is ‘the last evaluation.’ Raise  $s_3$  by 1:  $s_1 = \frac{-s_2 + 29}{2} = \frac{-s_2 + 1}{2} + 14$ . Apply kuṭṭaka to  $y = \frac{-x+1}{2}$ :  $(y, x) = (0 - k, 1 + 2k)$ . Hence follows  $(s_1, s_2) = (y + 14, x) = (14 - k, 1 + 2k) = (-s_4 + 14, 2s_4 + 1)$ , where  $k = s_4$  (pī 1). When  $s_4$  is raised by 0,  $(s_1, s_2, s_3) = (14, 1, 1)$ ; by 1,  $(13, 3, 1)$ ; by 2,  $(12, 5, 1)$ ; and by 3,  $(11, 7, 1)$ .

**Q9=E39:** Properties of two persons after mutual donation.

$x_i$  = properties of two persons ( $i = 1, 2$ ).

Statements of problem.  $x_1 + 100 = 2(x_2 - 100)$  and  $6(x_1 - 10) = x_2 + 10$ .

Solution. Let  $x_1 = s_1$  (yā 1) and  $x_2 = s_2$  (kā 1). Then, from  $s_1 + 100 = 2s_2 - 200$  follows  $s_1 = 2s_2 - 300$ , and from  $6s_1 - 60 = s_2 + 10$  follows  $s_1 = \frac{s_2 + 70}{6}$ . The first evaluation being reduced to the same denominator,  $s_1 = \frac{12s_2 - 1800}{6}$ . Hence follows the equation,  $12s_2 - 1800 = s_2 + 70$ . By the first seed,  $s_2 = 170$ . Raised by this,  $s_1 = 40$ .

**E77:** Equal properties of four persons in horses, camels, mules, and oxen.

$x_i$  = prices of a horse, a camel, a mule, and an ox ( $i = 1, 2, 3, 4$ ),  $u_i$  = property of the  $i$ -th person ( $i = 1, 2, 3, 4$ ).



Statements of problem.  $5x_1 + 2x_2 + 8x_3 + 7x_4 = u_1$ ,  $3x_1 + 7x_2 + 2x_3 + x_4 = u_2$ ,  $6x_1 + 4x_2 + x_3 + 2x_4 = u_3$ ,  $8x_1 + x_2 + 3x_3 + x_4 = u_4$ , and  $u_1 = u_2 = u_3 = u_4$ .

Solution. Let  $x_1 = s_1$  (yā 1),  $x_2 = s_2$  (kā 1),  $x_3 = s_3$  (nī 1), and  $x_4 = s_4$  (pī 1). Then, the properties of the four persons are:  $5s_1 + 2s_2 + 8s_3 + 7s_4$ ,  $3s_1 + 7s_2 + 2s_3 + s_4$ ,  $6s_1 + 4s_2 + s_3 + 2s_4$ , and  $8s_1 + s_2 + 3s_3 + s_4$ . From the first and the second follows the equation,  $5s_1 + 2s_2 + 8s_3 + 7s_4 = 3s_1 + 7s_2 + 2s_3 + s_4$ , from which an evaluation of  $s_1$  is obtained,  $s_1 = \frac{5s_2 - 6s_3 - 6s_4}{2}$ . Likewise, from the second and the third another evaluation of  $s_1$  is obtained,  $s_1 = \frac{3s_2 + s_3 - s_4}{3}$ ; and from the third and the fourth still another evaluation of  $s_1$  is obtained,  $s_1 = \frac{3s_2 - 2s_3 + s_4}{2}$ . From the first two of these three evaluations follows the equation,  $15s_2 - 18s_3 - 18s_4 = 6s_2 + 2s_3 - 2s_4$ , from which an evaluation of  $s_2$  is obtained,  $s_2 = \frac{20s_3 + 16s_4}{9}$ . Likewise, from the second and the third,  $s_2 = \frac{8s_3 - 5s_4}{3}$ . From these two evaluations of  $s_2$  follows an evaluation of  $s_3$ ,  $s_3 = \frac{31s_4}{4}$ . This is 'the last evaluation' to be solved by kuṭṭaka: KU (31, 4, 0)  $[y, x]$ . By the rules of BG 35 and 36ab,  $(y, x) = (0 + 31k, 0 + 4k)$ . Let  $k = s_5$  (lo 1). Then,  $s_3 = y = 31s_5 + 0$  and  $s_4 = x = 4s_5 + 0$ . Raised by these,  $s_2 = 76s_5 + 0$ . Then, raised by these values of  $s_2$ ,  $s_3$ , and  $s_4$ ,  $s_1 = 85s_5 + 0$ . When  $s_5 = 1$ ,  $(x_1, x_2, x_3, x_4) = (s_1, s_2, s_3, s_4) = (85, 76, 31, 4)$ ; when  $s_5 = 2$ ,  $(170, 152, 62, 8)$ ; when  $s_5 = 3$ ,  $(255, 228, 93, 12)$ ; etc.

**E78–79:** A hundred birds by a hundred dramma.

$x_i$  = number of birds of the  $i$ -th kind ( $i = 1, 2, 3, 4$ ),  $y_i$  = price of birds of the  $i$ -th kind ( $i = 1, 2, 3, 4$ ).

Statements of problem.  $x_1 + x_2 + x_3 + x_4 = 100$  ( $x_i$ 's are integers),  $y_1 + y_2 + y_3 + y_4 = 100$  dramma,  $\frac{y_1}{x_1} = \frac{3}{5}$ ,  $\frac{y_2}{x_2} = \frac{5}{7}$ ,  $\frac{y_3}{x_3} = \frac{7}{9}$ , and  $\frac{y_4}{x_4} = \frac{9}{3}$ .

Solution 1. Let  $y_1 = s_1$  (= yā 1) etc. Then,  $s_1 + s_2 + s_3 + s_4 = 100$ . Calculate  $x_i$  by proportion. Then,  $\frac{5}{3}s_1 + \frac{7}{5}s_2 + \frac{9}{7}s_3 + \frac{3}{9}s_4 = 100$ . The rest of this solution is omitted. According to the commentator Kṛṣṇa, the last equation is reduced to a common denominator and the denominators are eliminated:  $175s_1 + 147s_2 + 135s_3 + 35s_4 = 10500$ . 'The rest is the same as before.' This refers to the next solution which is treated first in his commentary.

Solution 2. In order that the statements,  $\frac{y_1}{x_1} = \frac{3}{5}$  etc. are realized, let  $x_1 = 5s_1$ ,  $x_2 = 7s_2$ ,  $x_3 = 9s_3$ ,  $x_4 = 3s_4$ ,  $y_1 = 3s_1$ ,  $y_2 = 5s_2$ ,  $y_3 = 7s_3$ , and  $y_4 = 9s_4$ . Then,  $3s_1 + 5s_2 + 7s_3 + 9s_4 = 100$ , and  $5s_1 + 7s_2 + 9s_3 + 3s_4 = 100$ . From these follow two evaluations of  $s_1$ ,  $s_1 = \frac{-5s_2 - 7s_3 - 9s_4 + 100}{3}$  and  $s_1 = \frac{-7s_2 - 9s_3 - 3s_4 + 100}{5}$ . By the reduction to a common denominator and elimination of the denominators,  $-25s_2 - 35s_3 - 45s_4 + 500 = -21s_2 - 27s_3 - 9s_4 + 300$ . From this follows an evaluation of  $s_2$ ,  $s_2 = -2s_3 - 9s_4 + 50$ . Assume  $s_4 = 4$ . Then,  $s_2 = -2s_3 + 14$ . Solve KU  $(-2, 1, 14) [y, x]$ :  $(y, x) = (14 - 2k, 0 + k)$ . Hence follow  $s_2$  and  $s_3$ :  $(s_2, s_3) = (y, x) = (-2s_5 + 14, s_5 + 0)$ , where  $k = s_5$  (= lo 1). Raise  $s_2$ ,  $s_3$ ,  $s_4$  in the evaluations of  $s_1$  with these values:  $s_1 = s_5 - 2$ . Assume  $s_5 = 3$ . Then,  $(s_1, s_2, s_3, s_4) = (1, 8, 3, 4)$ , from which, by raising  $s_i$  in  $x_i$

and in  $y_i$  with these values, follows the solution,  $(y_1, y_2, y_3, y_4) = (3, 40, 21, 36)$  and  $(x_1, x_2, x_3, x_4) = (5, 56, 27, 12)$ . Assume  $s_5 = 4$ . Then,  $(s_1, s_2, s_3, s_4) = (2, 6, 4, 4)$ , from which follows the solution,  $(y_1, y_2, y_3, y_4) = (6, 30, 28, 36)$  and  $(x_1, x_2, x_3, x_4) = (10, 42, 36, 12)$ . Assume  $s_5 = 5$ . Then,  $(s_1, s_2, s_3, s_4) = (3, 4, 5, 4)$ , from which follows the solution,  $(y_1, y_2, y_3, y_4) = (9, 20, 35, 36)$  and  $(x_1, x_2, x_3, x_4) = (15, 28, 45, 12)$ . Bhāskara's solution ends here but we have another set of solutions for  $s_5 = 6$  when  $s_4 = 4$ , that is,  $(s_1, s_2, s_3, s_4) = (4, 2, 6, 4)$ , from which follows the solution,  $(y_1, y_2, y_3, y_4) = (12, 10, 42, 36)$  and  $(x_1, x_2, x_3, x_4) = (20, 14, 54, 12)$ .

Bhāskara concludes his solution by the words, 'Likewise, there are many solutions according to the optional numbers.' In fact, there are two sets of solutions for  $s_4 = 11/3$ , five sets for  $s_4 = 13/3$ , three sets for  $s_4 = 14/3$ , and two sets for  $s_4 = 5$ ; in total, there are sixteen sets of solutions.

**E80:** Four divisions (purely numerical).

Statements of problem.  $x = 6q_1 + 5$ ,  $x = 5q_2 + 4$ ,  $x = 4q_3 + 3$ , and  $x = 3q_4 + 2$ .

Solution 1. Let  $x = s_1$  ( $= yā 1$ ), and  $q_1 = s_2$  ( $= kā 1$ ). Then, an evaluation of  $s_1$  is:  $s_1 = 6s_2 + 5$ . Likewise, let  $q_2 = s_3$  ( $= nī 1$ ),  $q_3 = s_4$  ( $= pī 1$ ), and  $q_4 = s_5$  ( $= lo 1$ ). Then, evaluations of  $s_1$  are:  $s_1 = 5s_3 + 4$ ,  $s_1 = 4s_4 + 3$ , and  $s_1 = 3s_5 + 2$ . From the first and the second evaluations follows an evaluation of  $s_2$ ,  $s_2 = \frac{5s_3-1}{6}$ . From the second and the third evaluations follows an evaluation of  $s_3$ ,  $s_3 = \frac{4s_4-1}{5}$ . From the third and the fourth evaluations follows an evaluation of  $s_4$ ,  $s_4 = \frac{3s_5-1}{4}$ . This is 'the last evaluation,' to which kuṭṭaka is applied:  $s_4 = 3s_6 + 2$  and  $s_5 = 4s_6 + 3$  ( $s_6 = ha 1$ ). Raised by this,  $s_3 = \frac{12s_6+7}{5}$ . Since this is a fraction, kuṭṭaka is applied again:  $\langle s_3 = 12s_7 + 11 \rangle$ ,  $s_6 = 5s_7 + 4$  ( $s_7 = śve 1$ ). Raised by this,  $s_5 = 4s_6 + 3 = 20s_7 + 19$ ,  $s_4 = 3s_6 + 2 = 15s_7 + 14$ ,  $s_3 = (4s_4 - 1)/5 = 12s_7 + 11$ ,  $s_2 = (5s_3 - 1)/6 = 10s_7 + 9$ , and  $s_1 = 6s_2 + 5 = 60s_7 + 59$ . (By raising  $s_7$  in  $s_1$  by 0, 1, 2, etc., there are many solutions:  $x = s_1 = 59, 119, 179$ , etc.) (E80p1)

Solution 2. From the first two statements follow two evaluations of  $s_1$ , that is,  $s_1 = 6s_2 + 5$  and  $s_1 = 5s_3 + 4$ , from which an evaluation of  $s_2$  is obtained,  $s_2 = \frac{5s_3-1}{6}$ . Since this is a fraction, kuṭṭaka is applied:  $s_2 = 5s_4 + 4$  and  $s_3 = 6s_4 + 5$ . Raised by this value of  $s_2$ ,  $s_1 = 30s_4 + 29$ . From the third statement,  $s_1 = 4s_5 + 3$ . The last two evaluations of  $s_1$  being combined, an evaluation of  $s_4$  is obtained,  $s_4 = \frac{4s_5-26}{30} = \frac{2s_5-13}{15}$ . Since this is a fraction, kuṭṭaka is applied again:  $s_4 = 2s_6 + 1$ ,  $s_5 = 15s_6 + 14$ . Raised by this value of  $s_4$ ,  $s_1 = 30(2s_6 + 1) + 29 = 60s_6 + 59$ . With this evaluation, the last statement is automatically realized. By raising  $s_6$  in  $s_1$  by 0, 1, 2, etc., there are many solutions:  $\langle x = s_1 = 59, 119, 179$ , etc.) (E80p2)

**E81:** Three divisions with conditions (purely numerical).

Statements of problem.  $5x = 20q + r$ ,  $7y = 20(q + 1) + (r + 1)$ ,  $9z = 20(q + 2) + (r + 2)$ , and  $0 \leq q = r < 18$ .

Solution. Let  $q = r = s_1$  ( $= yā 1$ ),  $x = s_2$  ( $= kā 1$ ),  $y = s_3$  ( $= nī 1$ ), and

$z = s_4 (= p\bar{1} 1)$ . Then,  $5s_2 - 20s_1 = s_1$ , from which follows an evaluation of  $s_1$ ,  $s_1 = \frac{5s_2}{21}$ . Also,  $7s_3 - 20s_1 - 20 = s_1 + 1$ , from which follows another evaluation of  $s_1$ ,  $s_1 = \frac{7s_3 - 21}{21}$ . Finally,  $9s_4 - 20s_1 - 40 = s_1 + 2$ , from which follows still another evaluation of  $s_1$ ,  $s_1 = \frac{9s_4 - 42}{21}$ . By equating the first evaluation to the second and the second to the third, one evaluation each of  $s_2$  and  $s_3$  is obtained,  $s_2 = \frac{7s_3 - 21}{5}$ ,  $s_3 = \frac{9s_4 - 21}{7}$ . The latter is 'the last evaluation,' to which kuṭṭaka is applied:  $(s_3, s_4) = (9s_5 + 6, 7s_5 + 7)$ . By raising  $s_3$  in  $s_2$  by this value of  $s_3$ ,  $s_2 = \frac{63s_5 + 21}{5}$ . By kuṭṭaka,  $(s_2, s_5) = (63s_6 + 42, 5s_6 + 3)$ . Raised by this value of  $s_5$ ,  $(s_3, s_4) = (45s_6 + 33, 35s_6 + 28)$ . By raising any one of the evaluations of  $s_1$  by these  $s_2$ ,  $s_3$ , and  $s_4$ ,  $s_1 = 15s_6 + 10$ . Since  $0 \leq s_1 < 18$ , there exists a solution only when  $s_6 = 0$ :  $(x, y, z) = (s_2, s_3, s_4) = (42, 33, 28)$ , and  $(q, q + 1, q + 2) = (r, r + 1, r + 2) = (s_1, s_1 + 1, s_1 + 2) = (10, 11, 12)$ .

**E82:** Three divisions with conditions (purely numerical).

Statements of problem.  $x = 2q_1 + 1$ ,  $x = 3q_2 + 2$ ,  $x = 5q_3 + 3$ ,  $q_1 = 2q_4 + 1$ ,  $q_2 = 3q_5 + 2$ , and  $q_3 = 5q_6 + 3$ .

Solution. Let  $x = s_1 (= y\bar{a} 1)$  and  $q_4 = s_2 (= k\bar{a} 1)$ . Then, from  $s_1 = 2q_1 + 1$  and  $q_1 = 2s_2 + 1$  follows an evaluation of  $s_1$ ,  $s_1 = 4s_2 + 3$ . Let  $q_5 = s_3 (= n\bar{1} 1)$ . Then, from  $s_1 = 3q_2 + 2$  and  $q_2 = 3s_3 + 2$  follows another evaluation of  $s_1$ ,  $s_1 = 9s_3 + 8$ . Equate the two evaluations of  $s_1$ :  $4s_2 + 3 = 9s_3 + 8$ , from which follows an evaluation of  $s_2$ ,  $s_2 = \frac{9s_3 + 5}{4}$ . Since this is a fraction, kuṭṭaka is applied:  $s_2 = 9s_4 + 8$  (and  $s_3 = 4s_4 + 3$ ) ( $s_4 = p\bar{1} 1$ ). Raised by this value of  $s_2$ ,  $s_1 = 36s_4 + 35$ . Let  $q_6 = s_5 (= lo 1)$ . Then, from  $s_1 = 5q_3 + 3$  and  $q_3 = 5s_5 + 3$  follows still another evaluation of  $s_1$ ,  $s_1 = 25s_5 + 18$ . Equate the last two evaluations:  $36s_4 + 35 = 25s_5 + 18$ , from which follows an evaluation of  $s_4$ ,  $s_4 = \frac{25s_5 - 17}{36}$ . Since this is a fraction, kuṭṭaka is applied:  $s_4 = 25s_6 + 3$  (and  $s_5 = 36s_6 + 5$ ) ( $s_6 = ha 1$ ). Raised by this value of  $s_4$ ,  $s_1 = 900s_6 + 143$ . By raising  $s_6$  by 0, 1, 2, etc., there are many solutions: (143, 1043, 1943, etc.)

**E83:** Five divisions (purely numerical).

Statements of problem.  $x = 5q_1 + 1$ ,  $y = 6q_2 + 2$ ,  $|x - y| = 3q_3 + 2$ ,  $x + y = 9q_4 + 5$ , and  $xy = 7q_5 + 6$ .

Solution 1. Let  $q_1 = q_2 = s_1 (= y\bar{a} 1)$ . Then, from the first two statements,  $|x - y| = s_1 + 1$ . Let  $q_3 = s_2 (= k\bar{a} 1)$ . Then, from the third statement,  $|x - y| = 3s_2 + 2$ . Therefore,  $s_1 + 1 = 3s_2 + 2$ , from which follows an evaluation of  $s_1$ ,  $s_1 = 3s_2 + 1$ . Raised by this,  $x = 15s_2 + 6$  and  $y = 18s_2 + 8$ . Let  $q_4 = s_3 (= n\bar{1} 1)$ . Then, from the fourth statement,  $x + y = 9s_3 + 5$ . Therefore,  $33s_2 + 14 = 9s_3 + 5$ , from which follows an evaluation of  $s_2$ ,  $s_2 = \frac{9s_3 - 9}{33}$ . Since this is a fraction, kuṭṭaka is applied:  $s_2 = 3s_4 + 0$  (and  $s_3 = 11s_4 + 1$ ) ( $s_4 = p\bar{1} 1$ ). Raised by this value of  $s_2$ ,  $x = 45s_4 + 6$  and  $y = 54s_4 + 8$ . The product of these  $x$  and  $y$  will contain the square of  $s_4$  and therefore the calculation will become long. Therefore, assume  $s_4$  in  $x$  to be unity. Then,  $x = 51 = 7 \cdot 7 + 2$ . On the other hand,  $y = 7 \cdot (7s_4 + 1) + (5s_4 + 1)$ .

Therefore,  $xy = 7q'_5 + (3s_4 + 2)$ . Assume  $q_5 - q'_5 = s_5$  ( $= lo\ 1$ ). Then,  $7s_5 + 6 = 3s_4 + 2$ , from which follows an evaluation of  $s_4$ ,  $s_4 = \frac{7s_5 + 4}{3}$ . Since this is a fraction, kuṭṭaka is applied:  $s_4 = 7s_6 + 6$  (and  $s_5 = 3s_6 + 2$ ) ( $s_6 = ha\ 1$ ). Raised by this value of  $s_4$ ,  $y = 378s_6 + 332$ . On the other hand,  $x = 45 \cdot 7s_6 + 51 = 315s_6 + 51$ . (Hence follow the solutions  $(x, y) = (315s_6 + 51, 378s_6 + 332)$ .)

Solution 2. Assume, at the very beginning,  $x$  to be a known number that satisfies the first statement and obtain  $y$  by calculation. For example, if one assumes  $x = 51$ , then  $y = 126s_7 + 80$  ( $s_7 = śve\ 1$ ). C (p. 240) omits this solution and instead (in fn. 2) refers to  $(x, y) = (6, 126s_6 + 8)$  and  $(36, 126s_6 + 104)$  given in Rāmakaṣṇa's commentary.

**E84:** Two divisions with a condition (purely numerical).

Statements of problem.  $9x = 30q_1 + r_1$ ,  $7x = 30q_2 + r_2$ ,  $q_1 + q_2 + r_1 + r_2 = 26$ , and  $0 \leq r_1, r_2 < 30$ .

Solution. Let  $x = s_1$  ( $= yā\ 1$ ) and  $q_1 + q_2 = s_2$  ( $= kā\ 1$ ). Then,  $r_1 + r_2 = 16s_1 - 30s_2$ . Add  $s_2$  ( $= q_1 + q_2$ ) to both sides:  $16s_1 - 29s_2 = 26$ , from which follows an evaluation of  $s_1$ ,  $s_1 = \frac{29s_2 + 26}{16}$ . Since this is a fraction, kuṭṭaka is applied:  $s_1 = 29s_3 + 27$  (and  $s_2 = 16s_3 + 14$ ) ( $s_3 = nī\ 1$ ). Since  $s_2 = q_1 + q_2 = 26 - (r_1 + r_2) \leq 26$ , there is a solution,  $\langle x = s_1 = 27 \rangle$ , only when  $s_3 = 0$ .

**E85:** Three divisions with a condition (purely numerical).

Statements of problem.  $3x = 30q_1 + r_1$ ,  $7x = 30q_2 + r_2$ ,  $9x = 30q_3 + r_3$ ,  $r_1 + r_2 + r_3 = 30q_4 + 11$ , and  $0 \leq r_i < 30$  ( $i = 1, 2, 3$ ).

Solution. Let  $x = s_1$  ( $= yā\ 1$ ). Then, from the first three statements,  $r_1 + r_2 + r_3 = 19s_1 - 30(q_1 + q_2 + q_3)$ , which is equal to  $(30q_4 + 11)$  according to the fourth statement. Hence follows the equation,  $19s_1 - 30(q_1 + q_2 + q_3 + q_4) = 11$ . Let  $q_1 + q_2 + q_3 + q_4 = s_2$  ( $= kā\ 1$ ). Then,  $19s_1 - 30s_2 = 11$ , from which follows an evaluation of  $s_1$ ,  $s_1 = \frac{30s_2 + 11}{19}$ . By kuṭṭaka,  $s_1 = 30s_3 + 29$ ,  $\langle s_2 = 19s_3 + 18 \rangle$  ( $s_3 = nī\ 1$ ).

**E86:** Two divisions with a condition (purely numerical).

Statements of problem.  $23x = 60q_1 + r_1$ ,  $23x = 80q_2 + r_2$ ,  $r_1 + r_2 = 100$ ,  $0 \leq r_1 < 60$ , and  $0 \leq r_2 < 80$ .

Solution is given after the following meta-rule.

**69:** A meta-rule.

'Here (in this type of problems), the values of more than one color in the dividend of the quotient of division should not be assumed optionally. If so done, the calculation would deviate from the right course.'

If in E86 we assume  $x = s_1$  ( $= yā\ 1$ ),  $q_1 = s_2$  ( $= kā\ 1$ ), and  $q_2 = s_3$  ( $= nī\ 1$ ), then from the first two statements follow  $r_1 = 23s_1 - 60s_2$  and  $r_2 = 23s_1 - 80s_3$ . Hence, by the third statement, follows the equation,  $46s_1 - 60s_2 - 80s_3 = 100$ , from

which an evaluation of  $s_1$  is obtained,  $s_1 = \frac{30s_2+40s_3+50}{23}$ . Usually,  $s_3$  can optionally be assumed to be a known number before kuṭṭaka is applied, but in this case it can not. For, if we do so,  $s_2$  must also be determined because  $s_2$  and  $s_3$  are not independent of each other.

Solution 1 of E86. Assume  $r_1 = 40$  and  $r_2 = 60$ , which realize the third statement, and let  $x = s_1$  ( $= yā 1$ ),  $q_1 = s_2$  ( $= kā 1$ ), and  $q_2 = s_3$  ( $= nī 1$ ). Then, from the first two statements follow two evaluations of  $s_1$ ,  $s_1 = \frac{60s_2+40}{23}$  and  $s_1 = \frac{80s_3+60}{23}$ , from which follows an evaluation of  $s_2$ ,  $s_2 = \frac{4s_3+1}{3}$ . By kuṭṭaka,  $s_2 = 4s_4 + 3$  and  $s_3 = 3s_4 + 2$  ( $s_4 = pī 1$ ). Raised by either of these,  $s_1 = \frac{240s_4+220}{23}$ . Again by kuṭṭaka,  $s_1 = 240s_5 + 20$  and  $s_4 = 23s_5 + 1$  ( $s_5 = lo 1$ ). Raised by this value of  $s_1$ ,  $x = 240s_5 + 20$ .

Solution 2 of E86. Assume  $r_1 = 30$  and  $r_2 = 70$ . Then, (in the same manner as solution 1,  $s_2 = \frac{4s_3+2}{3}$ . By kuṭṭaka,  $s_2 = 4s_4 + 2$  and  $s_3 = 3s_4 + 1$ . Raised by either of these,  $s_1 = \frac{240s_4+150}{23}$ . Again by kuṭṭaka,  $s_1 = 240s_5 + 90$  and  $s_4 = 23s_5 + 8$ . Raised by this value of  $s_1$ ,  $x = 240s_5 + 90$ .

**E87:** A division with a condition (purely numerical).

Statements of problem.  $5x = 13q + r$ ,  $x + q = 30$ , and  $0 \leq r < 13$ .

Solution. Let  $x = s_1$  ( $= yā 1$ ) and  $q = s_2$  ( $= kā 1$ ). Then,  $5s_1 = 13s_2 + r$  and  $s_1 + s_2 = 30$ . At this point of his solution, Bhāskara says, ‘Since this computation has no grounds, neither a multiplier nor divisor is recognized here,’ cites the following maxim, and begins a new solution after that. His statement, ‘neither a multiplier nor divisor is recognized here,’ seems to mean that kuṭṭaka cannot be applied to this problem, though, in fact, it can be.

**Q10:** A maxim on the ground (ādhāra) of computation.

‘If a computation has no grounds or insecure grounds, one should not employ that (computation). Why does it go well?’

Solution of E87. Assume  $r = 0$  and apply the iṣṭa-karman (L 51). That is, when  $r = 0$ , if  $x = 13$ , then  $q = 5$ . Hence follows the trairāśka: ‘If  $q$  is 5 when  $(x + q)$  is 18, then what is  $q$  when  $(x + q)$  is 30?’ That is,  $q = \text{TR}[18, 5, 30] = 25/3$ . Therefore,  $x = 30 - 25/3 = 65/3$ .

Bhāskara’s solution merely gives an approximation to the real one. In fact, from the first two statements follows the equation,  $5x = 390 - 13x + r$ , from which an evaluation of  $x$  is obtained,  $x = \frac{r+390}{18}$ . To this kuṭṭaka is applied; the only solution that satisfies the condition of  $r$  is  $(x, r) = (22, 6)$ , and  $q = 8$ .

**E88:** Buying and selling of fruits.

$x$  = buying rate (quantity/paṇa),  $y$  = selling rate (quantity/paṇa),  $q_i$  = paṇas obtained by the  $i$ -th person when the fruits are sold for the selling rate  $y$  ( $i = 1, 2, 3$ ),  $r_i$  = number of the remaining fruits ( $i = 1, 2, 3$ ).

Statements of problem.  $6x = yq_1 + r_1$ ,  $8x = yq_2 + r_2$ ,  $100x = yq_3 + r_3$ ,  $q_1 + 5r_1 = q_2 + 5r_2 = q_3 + 5r_3$ , and  $0 \leq r_i < y$  ( $i = 1, 2, 3$ ).

Solution. Let  $x = s_1$  ( $= y\bar{a} 1$ ) and  $q_1 = s_2$  ( $= k\bar{a} 1$ ) and assume  $y = 110$ . Then, from the first statement,  $r_1 = 6s_1 - 110s_2$ , and therefore  $q_1 + 5r_1 = 30s_1 - 549s_2$ . By *trairāśika*,  $q_2 = \text{TR}[6, s_2, 8] = \frac{4}{3}s_2$  and  $q_3 = \text{TR}[6, s_2, 100] = \frac{50}{3}s_2$  (which implies that  $s_2$  is divisible by 3), and therefore  $q_2 + 5r_2 = \frac{120}{3}s_1 - \frac{2196}{3}s_2$  and  $q_3 + 5r_3 = \frac{1500}{3}s_1 - \frac{27450}{3}s_2$ . From  $q_1 + 5r_1 = q_2 + 5r_2$  the equation,  $30s_1 - 549s_2 = \frac{120}{3}s_1 - \frac{2196}{3}s_2$ , is obtained, from which follows an evaluation of  $s_1$ ,  $s_1 = \frac{549s_2}{30}$  (which should not be reduced to  $\frac{183s_2}{10}$  because  $s_2$  must be divisible by 3). Also from the other two statements,  $q_2 + 5r_2 = q_3 + 5r_3$  and  $q_1 + 5r_1 = q_3 + 5r_3$ , the same evaluation of  $s_1$  is obtained. By *kuṭṭaka*,  $s_1 = 549s_3 + 0$  (and  $s_2 = 30s_3 + 0$ ) ( $s_3 = n\bar{1} 1$ ). When  $s_3 = 1$ ,  $x = s_1 = 549$ . (By the first three statements with  $(x, y) = (549, 110)$ , the quotients and the corresponding remainders are obtained:  $(q_1, q_2, q_3) = (29, 39, 499)$ ,  $(r_1, r_2, r_3) = (104, 102, 10)$ , from which follows  $q_i + 5r_i = 549$  for every  $i$ .) (For other solutions see after Q11.)

Note that this solution has a contradiction caused by the unwarranted use of *trairāśika*: the *trairāśika* in Bhāskara's solution brings the relationship  $30s_1 = 549s_2$ , which in turn makes the property of each person after the selling of the fruits zero:  $q_i + 5r_i = 30s_1 - 549s_2 = 0$ . Bhāskara's remarks after the solution are presumably related with this fact. He says (in E88p2): 'This (example) was told by our predecessors for the case of insecure computation and solved after an equation was somehow made. Here, an assumption was made (by me) in such a way that the computation, though its grounds were insecure, might come to an answer like a computation with secure grounds. Wherever (a computation) is deviating from the right course due to the contraction of computation based on this kind of assumption, (the answer) should be reconciled (with the statements) by means of intelligence by intelligent people.' And then he cites the next maxim which refers to five causes of the computation of *bīja-gaṇita*, including the intelligence (*mati*).

**Q11:** A maxim on the cause (*hetu*) of computation.

'Statement, stainless intelligence, assumption of unknown numbers, equation, and *trairāśika*: these must be the cause of computation everywhere in *bīja-gaṇita*.'

Other solutions of E88. Substituting  $r_i$  obtained from the first three statements for those in the next three statements, we have  $q_1 + 5(6x - yq_1) = q_2 + 5(8x - yq_2) = q_3 + 5(100x - yq_3)$ , from which follow  $(5y - 1)(q_2 - q_1) = 10x$ ,  $(5y - 1)(q_3 - q_2) = 460x$ , and  $(5y - 1)(q_3 - q_1) = 470x$ . By putting  $q_2 - q_1 = 5n$ , we have  $n(5y - 1) = 2x$ ,  $q_3 - q_2 = 230n$ , and  $q_3 - q_1 = 235n$ .

When  $n = 1$ , solving  $y = (2x + 1)/5$  by *kuṭṭaka*, we have  $(y, x) = (1 + 2k, 2 + 5k)$ , and  $q_2 = q_1 + 5$  and  $q_3 = q_1 + 235$ . From the first three statements, we have  $6(2 + 5k) = (1 + 2k)q_1 + r_1$ ,  $8(2 + 5k) = (1 + 2k)(q_1 + 5) + r_2$ , and  $100(2 + 5k) =$

$(1 + 2k)(q_1 + 235) + r_3$ . Therefore,  $r_1 - r_2 = 1$ ,  $r_2 - r_3 = 46$ ,  $r_1 - r_3 = 47$ . Hence follows  $r_1 \geq 48$ . The solutions are as follows ( $p = q_i + 5r_i$ ).

$k$	$x$	$y$	$q_1$	$r_1$	$q_2$	$r_2$	$q_3$	$r_3$	$p$
25	127	51	14	48	19	47	249	1	254
26	132	53	14	50	19	49	249	3	264
27	137	55	14	52	19	51	249	5	274
etc.									

When  $n = 2$ , solving  $y = (x + 1)/5$  by kuṭṭaka, we have  $(y, x) = (1 + k, 4 + 5k)$ , and  $q_2 = q_1 + 10$  and  $q_3 = q_1 + 470$ . In exactly the same way as above,  $r_1 - r_2 = 2$ ,  $r_2 - r_3 = 92$ ,  $r_1 - r_3 = 94$ . Hence follows  $r_1 \geq 95$ . The solutions are as follows. Bhāskara's solution falls in this group ( $k = 109$ ).

$k$	$x$	$y$	$q_1$	$r_1$	$q_2$	$r_2$	$q_3$	$r_3$	$p$
100	504	101	29	95	39	93	499	1	504
101	509	102	29	96	39	94	499	2	509
102	514	103	29	97	39	95	499	3	514
⋮									
109	549	110	29	104	39	102	499	10	549
etc.									

When  $n = 3$ , solving  $y = (2x+3)/15$  by kuṭṭaka, we have  $(y, x) = (1+2k, 6+15k)$ , and  $q_2 = q_1 + 15$  and  $q_3 = q_1 + 705$ . In exactly the same way as above,  $r_1 - r_2 = 3$ ,  $r_2 - r_3 = 138$ ,  $r_1 - r_3 = 141$ . Hence follows  $r_1 \geq 142$ . The solutions are as follows. Etc., etc.

$k$	$x$	$y$	$q_1$	$r_1$	$q_2$	$r_2$	$q_3$	$r_3$	$p$
75	1131	151	44	142	59	139	749	1	754
76	1146	153	44	144	59	141	749	3	764
77	1161	155	44	146	59	143	749	5	774
etc.									

III.1.10 Chapter 10: Elimination of the middle term of (equations in) more than one color

**70–73:** Rule 1.

0. If the equation after the equal subtraction contains the square etc. of unknown number, make the side of unknown a square number (cf. steps 0 and 1 of the rule for the second seed, BG 59–61).

1. Type  $(as_1 + b)^2 = cs_2^2 + d$ . Apply varga-prakṛti to the second side: VP(c)  $[\alpha, \beta, d]$ . Then,  $s_2 = \alpha$ , and from  $as_1 + b = \beta$  follows  $s_1$ . (70–71ab)

2. Type  $(as_1 + b)^2 = cs_2^2 + ds_2 + e$  ( $d \neq 0$ ). Let  $cs_2^2 + ds_2 + e = s_3^2$ . By the equal subtraction,  $cs_2^2 + ds_2 = s_3^2 - e$ . Make the first side a square number:

$(cs_2 + f)^2 = cs_3^2 + g$  (where  $f = d/2$ ,  $g = -ce + d^2/4$ ). Apply varga-prakṛti to the second side: VP (c)  $[\alpha, \beta, g]$ . Then, from  $as_1 + b = \alpha$  follows  $s_1$  and from  $cs_2 + f = \beta$  follows  $s_2$ . (71cd–72ab)

3. ‘Intelligent people should consider in various ways so that one side of the equation may become the object of varga-prakṛti.’ (72cd)

4. ‘The (bona fide) seed is the intelligence accompanied by various colors, which, explained fully in order to awaken dull people by my learned predecessors who are for calculators just as the sun is for red lotus, has come to possess the state of being what is called seed mathematics (bīja-gaṇita).’ (73)

**74–75:** Rule 2.

Type  $(as_1 + b)^2 = cs_2^2 + d$ . Apply varga-prakṛti to the second side: VP (c)  $[\alpha, \beta, d]$ . Then,  $s_2 = \alpha$ , and  $s_1$  follows from  $as_1 + b = \beta$ .

This rule is the same as rule 1.1 but detailed fully here.

**E89:** A quadratic equation in two unknown numbers.

Statement of problem.  $6x^2 + 2x = u^2$ .

Solution. Let  $x = s_1$  ( $= yā 1$ ) and  $u = s_2$  ( $= kā 1$ ). Then,  $6s_1^2 + 2s_1 = s_2^2$ . Multiplied by 6 and increased by 1,  $36s_1^2 + 12s_1 + 1 = 6s_2^2 + 1$  or  $(6s_1 + 1)^2 = 6s_2^2 + 1$ . Apply rule 1 of varga-prakṛti to the second side: VP (6)  $[2, 5, 1]$ . By rule 2, VP (6)  $[20, 49, 1]$ . Hence follow  $s_2 = 2$  and 20. From  $6s_1 + 1 = 5$  and 49 follow  $s_1 = 2/3$  and 8. Raised by these,  $(x, u) = (2/3, 2)$  and  $(8, 20)$ . Likewise, there are many solutions according to the solutions of VP (6)  $[x, y, 1]$ .

**E90:** A cubic equation in two unknown numbers.

Statement of problem.  $(x + y)^2 + (x + y)^3 = 2(x^3 + y^3)$ .

Solution. Let  $x = s_1 - s_2$  ( $= yā 1 kā 1$ ) and  $y = s_1 + s_2$  ( $= yā 1 kā 1$ ). Then,  $x + y = 2s_1$  and therefore the first side  $= 8s_1^3 + 4s_1^2$ . From  $x^3 = s_1^3 - 3s_1^2s_2 + 3s_1s_2^2 - s_2^3$  and  $y^3 = s_1^3 + 3s_1^2s_2 + 3s_1s_2^2 + s_2^3$  follows that the second side  $= 2(2s_1^3 + 6s_1s_2^2) = 4s_1^3 + 12s_1s_2^2$ . The statement is rewritten as  $8s_1^3 + 4s_1^2 = 4s_1^3 + 12s_1s_2^2$ . By the equal subtraction,  $4s_1^3 + 4s_1^2 = 12s_1s_2^2$ . Divided by  $s_1$  and increased by 1,  $4s_1^2 + 4s_1 + 1 = 12s_2^2 + 1$  or  $(2s_1 + 1)^2 = 12s_2^2 + 1$ . Apply rule 1 of varga-prakṛti to the second side: VP (12)  $[2, 7, 1]$ . By rule 2, VP (12)  $[28, 97, 1]$ . Hence follow  $s_2 = 2$  and 28. From  $2s_1 + 1 = 7$  and 97 follow  $s_1 = 3$  and 48. Raised by these,  $(x, y) = (s_1 - s_2, s_1 + s_2) = (1, 5), (20, 76)$ , etc.

**76–77ab:** Rule 3.

1. Type  $(as_1 + b)^2 = cs_2^4 + ds_2^2$ . Divide the second side by  $s_2^2$ :  $cs_2^2 + d$ . To this apply varga-prakṛti: VP (c)  $[\alpha, \beta, d]$ . Then,  $s_2 = \alpha$ , and from  $as_1 + b = \alpha\beta$  follows  $s_1$ .

2. Type  $(as_1 + b)^2 = cs_2^6 + ds_2^4$ . Divide the second side by  $(s_2^2)^2$ :  $cs_2^2 + d$ . To this apply varga-prakṛti: VP (c)  $[\alpha, \beta, d]$ . Then,  $s_2 = \alpha$ , and from  $as_1 + b = \alpha^2\beta$  follows



$s_1$ .

**E91:** A bi-quadratic equation in two unknown numbers.

Statement of problem.  $5(x^2)^2 - 100x^2 = u^2$ .

Solution. Let  $x = s_1$  ( $= yā 1$ ) and  $u^2 = s_2^2$  ( $= kāva 1$ ). Then,  $5(s_1^2)^2 - 100s_1^2 = s_2^2$ . Divided by  $s_1^2$ ,  $5s_1^2 - 100 = (s_2/s_1)^2$ . By varga-prakṛti, VP (5) [10, 20, -100], VP (5) [170, 380, -100], etc. That is to say,  $(s_1, s_2/s_1) = (10, 20), (170, 380)$ , etc. Hence follow  $(x, u) = (s_1, s_2) = (10, 200), (170, 64600)$ , etc.

**E92:** A system of cubic equations in two main and two auxiliary unknown numbers.

Statements of problem.  $x - y = u^2$  and  $x^2 + y^2 = v^3$ .

Solution. Let  $y = s_1$  ( $= yā 1$ ),  $x = s_2$  ( $= kā 1$ ), and  $u = s_3$  ( $= nī 1$ ). Then, from the first statement follows the value of  $s_1$ ,  $s_1 = s_2 - s_3^2$ . Therefore,  $x^2 + y^2 = s_2^2 + (s_2 - s_3^2)^2 = 2s_2^2 - 2s_2s_3^2 + (s_3^2)^2$ . Let  $v = s_3^2$ . Then, from the second statement follows the equation,  $2s_2^2 - 2s_2s_3^2 + (s_3^2)^2 = (s_3^2)^3$ . By the equal subtraction,  $(s_3^2)^3 - (s_3^2)^2 = 2s_2^2 - 2s_2s_3^2$ . Multiplied by 2 and increased by  $(s_3^2)^2$ ,  $2(s_3^2)^3 - (s_3^2)^2 = 4s_2^2 - 4s_2s_3^2 + (s_3^2)^2$ . The second side is  $(2s_2 - s_3^2)^2$ . The first side, divided by  $(s_3^2)^2$ , is  $2s_3^2 - 1$ . To this apply varga-prakṛti: VP (2) [5, 7, -1], VP (2) [29, 41, -1], etc. Hence follow the roots of the first side,  $5^2 \cdot 7 = 175$ ,  $29^2 \cdot 41 = 34481$ , etc. On the other hand, the corresponding roots of the second side are  $2s_2 - 25$ ,  $2s_2 - 841$ , etc. Hence follow the equations,  $175 = 2s_2 - 25$ ,  $34481 = 2s_2 - 841$ , etc. Therefore,  $s_2 = 100$ ,  $17661$ , etc. Raised by these values,  $s_1 = 75$ ,  $16820$ , etc. Hence follow the solutions,  $(x, y) = (s_2, s_1) = (100, 75), (17661, 16820)$ , etc.

**77cd–78:** Rule 4.

Type  $(as_1 + b)^2 = cs_2^2 + ds_2 + e$  ( $d \neq 0$ ). Let  $cs_2^2 + ds_2 + e = s_3^2$ . Make the second side (of the original equation) a square number,  $(cs_2 + d/2)^2 = cs_3^2 - ce + d^2/4$ . To this apply rule 2 (BG 74–75). In other words, apply varga-prakṛti to the third side,  $cs_3^2 - ce + (d/2)^2$ : VP (c) [ $\alpha, \beta, -ce + d^2/4$ ]. Then, from  $as_1 + b = \alpha$  follows  $s_1$ , and from  $cs_2 + d/2 = \beta$  follows  $s_2$ .

This rule is the same as rule 1.2 but detailed fully here.

**E93:** Two sums of an arithmetical progression (quadratic equation in two unknown numbers).

$a, d$  = the first term and the increase (common difference) of an arithmetical progression,  $x, y$  = numbers of terms,  $A(n)$  = the sum of the first  $n$  terms of the progression.

Statements of problem.  $a = 3, d = 2, 3A(x) = A(y)$ , (and  $A(n) = \frac{n}{2}\{2a + d(n - 1)\}$ ).

Solution. Let  $x = s_1$  ( $= yā 1$ ) and  $y = s_2$  ( $= kā 1$ ). Then,  $3s_1^2 + 6s_1 = s_2^2 + 2s_2$ . Multiplied by 3 and increased by 9,  $9s_1^2 + 18s_1 + 9 = 3s_2^2 + 6s_2 + 9$ . The first side is  $(3s_1 + 3)^2$ . The second side is  $3s_2^2 + 6s_2 + 9$ , which is equated to a third

side,  $s_3^2$  (= nīva 1):  $3s_2^2 + 6s_2 + 9 = s_3^2$ . Multiplied by 3 and increased by  $-18$ ,  $9s_2^2 + 18s_2 + 9 = 3s_3^2 - 18$ . The second side (of the original equation) is  $(3s_2 + 3)^2$ . Apply varga-prakṛti to the third side: VP (3) [9, 15,  $-18$ ], VP (3) [33, 57,  $-18$ ], etc. From  $3s_1 + 3 = s_3 = 9, 33$ , etc. follow  $s_1 = 2, 10$ , etc.; from  $3s_2 + 3 = 15, 57$ , etc. follow  $s_2 = 4, 18$ , etc. Raised by these,  $(x, y) = (s_1, s_2) = (2, 4), (10, 18)$ , etc.

**79–80:** Rule 5.

1. Type  $(as_1 + b)^2 = cs_2^2 + ds_3^2 + e$ . Apply varga-prakṛti to the second side, regarding  $s_2$  as unknown number ( $c$  as prakṛti) and the rest  $(ds_3^2 + e)$  as the additive: VP ( $c$ ) [ $\alpha, \beta, ds_3^2 + e$ ], where  $\alpha$  ( $= s_2$ ) is assumed to be  $fs_3 + g$  by choosing such  $f$  and  $g$  that make the second side a square number. Then,  $\beta$  will be obtained as  $hs_3 + i$ , (which is the root of the second side and therefore the root of the first side as well. Hence follows the linear equation,  $as_1 + b = hs_3 + i$ , while  $s_2 = \alpha = fs_3 + g$ .) (BG 79)

2. Type  $(as_1 + b)^2 = cs_2^2 + ds_2s_3 + es_3^2$  (with bhāvita). ‘Take the square-root of as much part as possible of the second side,’ that is to say, let  $cs_2^2 + ds_2s_3 + es_3^2 = (fs_2 + gs_3)^2 + hs_3^2$ , where  $f = \sqrt{c}$ ,  $g = d/2\sqrt{c}$ , and  $h = (4ce - d^2)/4c$ . Then,

$$fs_2 + gs_3 = \left( \frac{hs_3^2}{m} - m \right) \div 2, \left( as_1 + b = \left( \frac{hs_3^2}{m} + m \right) \div 2 \right),$$

where  $m$  is any optional number. (BG 80)

Bhāskara does not refer to the latter relationship; his example (E96) does not require  $as_1 + b$ .

If we assume  $m = is_3$ , then  $fs_2 + gs_3 = \frac{h-i^2}{2i}s_3$ ,  $as_1 + b = \frac{h+i^2}{2i}s_3$ . These relationships are not mentioned in rule 5 but used in Bhāskara’s solution of E96.

Before one takes the square-root of part of the second side, one may multiply the second side by an appropriate square number so that the coefficients may be integers. In his solution of E96, Bhāskara multiply it by 36 and obtain  $c = d = e = 1$ . In that case, of course, the root obtained,  $as_1 + b$ , should be divided by its square-root but, as mentioned above, Bhāskara’s example does not require its value.

The following are the supplementary rules briefly mentioned in 80p1 and in 80p3–p4.

3. Supplementary rule to 5.1. If the prakṛti is a square number, apply rule 9 for varga-prakṛti (BG 54). That is to say, if the second side is  $c^2s_2^2 + ds_3^2 + e$ , then

$$\text{VP} (c^2) \left[ \left( \frac{ds_3^2 + e}{m} - m \right) \div 2 \div c, \left( \frac{ds_3^2 + e}{m} + m \right) \div 2, ds_3^2 + e \right],$$

where  $m$  is any optional number. Therefore,  $s_2 = \left( \frac{ds_3^2 + e}{m} - m \right) \div 2 \div c$  and  $as_1 + b = \left( \frac{ds_3^2 + e}{m} + m \right) \div 2$ . (BG 80p1)

4. Supplementary rule to 5.1 and 5.2. If there are more than two unknown numbers in the second side, assume known numbers for them except two. (BG 80p3)

5. Supplementary rule to 5.1 and 5.2. These rules are applicable only when other statement or condition exists. If not, assume known numbers for them except one. (BG 80p4)

**E94:** A system of quadratic equations in two main and two auxiliary unknown numbers.

Statements of problem.  $7x^2 + 8y^2 = u^2$  and  $7x^2 - 8y^2 + 1 = v^2$ .

Solution. Let  $x = s_1$  ( $= yā 1$ ),  $y = s_2$  ( $= kā 1$ ), and  $u = s_3$  ( $= nī 1$ ). Then, from the first statement follows the equation,  $7s_1^2 + 8s_2^2 = s_3^2$ . Solve VP (7)  $[s_1, s_3, 8s_2^2]$  according to rule 1 of varga-prakṛti: VP (7)  $[2s_2, 6s_2, 8s_2^2]$ . Raise  $x$  in the second statement by this value ( $2s_2$ ) of  $x$ : VP (20)  $[s_2, v, 1]$ . Solve this by rule 1 of varga-prakṛti: VP (20)  $[2, 9, 1]$ . By rule 2,  $BH^+(20) \left[ \begin{smallmatrix} 2 & 9 & 1 \\ 2 & 9 & 1 \end{smallmatrix} \right] = VP(20) [36, 161, 1]$ , from which follow  $s_2 = 2, 36$ , etc. Raised by these values,  $(x, y) = (s_1, s_2) = (2s_2, s_2) = (4, 2), (72, 36)$ , etc.

**E95:** A system of cubic equations in two main and two auxiliary unknown numbers.

Statements of problem.  $x^2 + y^3 = u^2$  and  $x + y = v^2$ .

Solution 1.  $x = s_1$  ( $= yā 1$ ),  $y = s_2$  ( $= kā 1$ ), and  $u = s_3$  ( $= nī 1$ ). Then, from the first statement follows the equation,  $s_1^2 + s_2^3 = s_3^2$ . Solve VP (1)  $[s_1, s_3, s_2^3]$  according to rule 9 for the varga-prakṛti (BG 54) with  $m = s_2$ :

$$s_1 = \left( \frac{s_2^3}{s_2} - s_2 \right) \div 2 \div 1 = \frac{s_2^2 - s_2}{2}, \quad s_3 = \left( \frac{s_2^3}{s_2} + s_2 \right) \div 2 = \frac{s_2^2 + s_2}{2}.$$

Therefore,  $x + y = \frac{s_2^2 + s_2}{2}$ . Let  $v = s_4$  ( $= pī 1$ ). Then, from the second statement follows the equation,  $\frac{s_2^2 + s_2}{2} = s_4^2$ , or  $s_2^2 + s_2 = 2s_4^2$ . Multiplied by 4 and increased by 1,  $4s_2^2 + 4s_2 + 1 = 8s_4^2 + 1$ , or  $(2s_2 + 1)^2 = 8s_4^2 + 1$ . Solve VP (8)  $[s_4, w, 1]$  by rule 1 of varga-prakṛti: VP (8)  $[1, 3, 1]$ . By rule 2,  $BH^+(8) \left[ \begin{smallmatrix} 1 & 3 & 1 \\ 1 & 3 & 1 \end{smallmatrix} \right] = VP(8) [6, 17, 1]$ . Again by rule 2,  $BH^+(8) \left[ \begin{smallmatrix} 1 & 3 & 1 \\ 6 & 17 & 1 \end{smallmatrix} \right] = VP(8) [35, 99, 1]$ . Then, from  $2s_2 + 1 = w = 17$  follow  $s_2 = 8$  and  $s_1 = 28$ ; from  $2s_2 + 1 = w = 99$  follow  $s_2 = 49$  and  $s_1 = 1176$ . Raised by these,  $(x, y) = (s_1, s_2) = (28, 8)$  and  $(1176, 49)$ . (E95p1)

Solution 2. Let  $y = 2s_1^2$  ( $= yāva 2$ ) and  $x = 7s_1^2$  ( $= yāva 7$ ). Then, since  $x + y = (3s_1)^2$ , the second statement is automatically realized. Let  $u = s_2$  ( $= kā 1$ ). Then, from the first statement follows the equation,  $49(s_1^2)^2 + 8(s_1^2)^3 = s_2^2$ , or  $8s_1^2 + 49 = (s_2/s_1^2)^2$ . Solve VP (8)  $[s_1, s_2/s_1^2, 49]$  by rule 1 of varga-prakṛti: VP (8)  $[2, 9, 49]$  and VP (8)  $[3, 11, 49]$ . By rule 2,  $BH^+(8) \left[ \begin{smallmatrix} 2 & 9 & 49 \\ 3 & 11 & 49 \end{smallmatrix} \right] = VP(8) [49, 147, 49^2]$ , from which, by rule 3 of varga-prakṛti with  $a = 7$ , follows VP (8)  $[7, 21, 49]$ . Therefore,  $(y, x) = (2s_1^2, 7s_1^2) = (8, 28), (18, 63),$  and  $(98, 343)$ . (E95p2)

**E96:** A system of quadratic equations in two main and two auxiliary unknown numbers.

Statements of problem.  $x^2 + xy + y^2 = u^2$ ,  $(x + y)u + 1 = v^2$ .

Solution. Let  $x = s_1$  ( $= y\bar{a} 1$ ),  $y = s_2$  ( $= k\bar{a} 1$ ), and  $u = s_3$  ( $= n\bar{i} 1$ ). Then, from the first statement follows the equation,  $s_1^2 + s_1s_2 + s_2^2 = s_3^2$ . By the equal subtraction,  $s_1^2 + s_1s_2 = s_3^2 - s_2^2$ ; increased by  $s_2^2$ ,  $s_1^2 + s_1s_2 + s_2^2 = s_3^2$ ; and multiplied by 36,  $36s_1^2 + 36s_1s_2 + 36s_2^2 = 36s_3^2$ . The second side is  $(6s_3)^2$ , while the first side is  $(6s_1 + 3s_2)^2 + 27s_2^2$ , to which rule 5.2 (BG 80) is applied: with  $m = s_2$ ,  $6s_1 + 3s_2 = (27s_2^2/s_2 - s_2)/2 = 13s_2$ , from which follows  $s_1 = \frac{5}{3}s_2$ . Raised by this,  $(x, y) = (\frac{5}{3}s_2, s_2)$ . Hence follows  $s_3^2 = s_1^2 + s_1s_2 + s_2^2 = \frac{49}{9}s_2^2$ , or  $s_3 = \frac{7}{3}s_2$ . Let  $v = s_4$  ( $= p\bar{i} 1$ ). Then, from the second statement follows the equation,  $(\frac{5}{3}s_2 + s_2) \times \frac{7}{3}s_2 + 1 = s_4^2$ , or  $(56s_2^2 + 9)/9 = s_4^2$ . Through the reduction to a common denominator, elimination of the denominators and equal subtraction,  $56s_2^2 = 9s_4^2 - 9$ . Increased by 9,  $56s_2^2 + 9 = 9s_4^2$ . Solve VP (56) [ $s_2, 3s_4, 9$ ] by rule 1 of varga-prakṛti: VP (56) [6, 45, 9]. By rule 2,  $BH^+(56) \left[ \begin{smallmatrix} 6 & 45 & 9 \\ 6 & 45 & 9 \end{smallmatrix} \right] = VP (45) [540, 4041, 9^2]$ , from which, by rule 3 of varga-prakṛti with  $a = 3$ , follows VP (56) [180, 1347, 9]. Therefore,  $(x, y) = (10, 6)$  and  $(300, 180)$ . Likewise, there are many other solutions.

**E97:** A system of cubic equations in two main and six auxiliary unknown numbers.

Statements of problem.  $x + y + 2 = r^2$ ,  $x - y + 2 = u^2$ ,  $x^2 + y^2 = v^2$ ,  $x^2 - y^2 + 8 = w^2$ ,  $(xy + y)/2 = t^3$ ,  $r + u + v + w + t = q^2$ .

Solution 1. Let  $x = s_1^2 - 1$  ( $= y\bar{a}va 1 r\bar{u} \dot{1}$ ),  $y = 2s_1$  ( $= y\bar{a} 2$ ), and  $q = s_2$  ( $= k\bar{a} 1$ ). Then, from all the six statements follows the equation,  $2s_1^2 + 3s_1 - 2 = s_2^2$ . Multiplied by 8 and increased by 25,  $16s_1^2 + 24s_1 + 9 = 8s_2^2 + 25$ , or  $(4s_1 + 3)^2 = 8s_2^2 + 25$ . Solve VP (8) [ $s_2, s_3, 25$ ] by rule 1 of varga-prakṛti: VP (8) [5, 15, 25]. By rule 2 of varga-prakṛti,  $BH^+(8) \left[ \begin{smallmatrix} 5 & 15 & 25 \\ 5 & 15 & 25 \end{smallmatrix} \right] = VP (8) [150, 425, 25^2]$ , from which, by rule 3 of varga-prakṛti with  $a = 5$ , follows VP (8) [30, 85, 25]. By rule 2 of varga-prakṛti,  $BH^+(8) \left[ \begin{smallmatrix} 5 & 15 & 25 \\ 30 & 85 & 25 \end{smallmatrix} \right] = VP (8) [875, 2475, 25^2]$ , from which, by rule 3 for the varga-prakṛti with  $a = 5$ , follows VP (8) [175, 495, 25]. From  $4s_1 + 3 = s_3$  follow the values of  $s_1$ :  $s_1 = 3$  when  $s_3 = 15$ ;  $s_1 = \frac{41}{2}$  when  $s_3 = 85$ ; and  $s_1 = 123$  when  $s_3 = 495$ . Raised by these,  $(x, y) = (8, 6)$ ,  $(\frac{1677}{4}, 41)$ , and  $(15128, 246)$ . Likewise, there are many other solutions. (E97p1–p2)

In E97p3, Bhāskara also gives three kinds of ‘assumption’ (kalpanā) or the initial setting of unknown numbers for other solutions.

Solution 2. Let  $x = s_1^2 + 2s_1$  ( $y\bar{a}va 1 y\bar{a} 2$ ) and  $y = 2s_1 + 2$  ( $y\bar{a} 2 r\bar{u} 2$ ).

Solution 3. Let  $x = s_1^2 - 2s_1$  ( $y\bar{a}va 1 y\bar{a} \dot{2}$ ) and  $y = 2s_1 - 2$  ( $y\bar{a} 2 r\bar{u} \dot{2}$ ).

Solution 4. Let  $x = s_1^2 + 4s_1 + 3$  ( $y\bar{a}va 1 y\bar{a} 4 r\bar{u} 3$ ) and  $y = 2s_1 + 4$  ( $y\bar{a} 2 r\bar{u} 4$ ).

**81:** A meta rule on the assumption.

‘In this way, there are thousands of assumptions (even for a single problem) but

they are hidden against ignorant people. In mercy to them, therefore, a method for assumption is told here.'

**82–83:** Rule 6.

Type  $x + y + a = r^2$ ,  $x - y + a = u^2$ ,  $x^2 + y^2 + b = v^2$ ,  $x^2 - y^2 + c = w^2$ . Let  $u = s_1 + p$  and  $r = u + \sqrt{c/a}$ , and obtain  $x$  and  $y$  expressed in  $s_1$  from  $x + y = r^2 - a$  and  $x - y = u^2 - a$  by means of the rule of concurrence (L 56). (Then, raise  $x^2 + y^2 + b = v^2$  by these values of  $x$  and  $y$  to obtain  $s_1$ .)

**E98:** A system of cubic equations in two main and six auxiliary unknown numbers.

Statements of problem.  $x + y + 3 = r^2$ ,  $x - y + 3 = u^2$ ,  $x^2 + y^2 - 4 = v^2$ ,  $x^2 - y^2 + 12 = w^2$ ,  $xy/2 + y = t^3$ ,  $r + u + v + w + t + 2 = q^2$ .

Solution.

Assumption 1. According to rule 6, let  $p = -1$ , that is,  $u = s_1 - 1$  (=  $y\bar{a} 1 r\bar{u} 1$ ). Then,  $r = s_1 - 1 + \sqrt{12/3} = s_1 + 1$ , and  $x + y = (s_1 + 1)^2 - 3 = s_1^2 + 2s_1 - 2$ , and  $x - y = (s_1 - 1)^2 - 3 = s_1^2 - 2s_1 - 2$ . By the rule of concurrence (L 56),  $x = s_1^2 - 2$  and  $y = 2s_1$ .

Assumption 2. Or, otherwise, let  $p = 0$ , that is,  $u = s_1$  (=  $y\bar{a} 1$ ). Then,  $r = s_1 + \sqrt{12/3} = s_1 + 2$ , and  $x + y = (s_1 + 2)^2 - 3 = s_1^2 + 4s_1 + 1$ , and  $x - y = s_1^2 - 3$ . By the rule of concurrence (L 56),  $x = s_1^2 + 2s_1 - 1$  and  $y = 2s_1 + 2$ .

On assumption 1,  $x + y + 3 = (s_1 + 1)^2$ ,  $x - y + 3 = (s_1 - 1)^2$ ,  $x^2 + y^2 - 4 = (s_1^2)^2$ ,  $x^2 - y^2 + 12 = (s_1^2 - 4)^2$ , and  $xy/2 + y = s_1^3$ . Therefore,  $r + u + v + w + t + 2 = 2s_1^2 + 3s_1 - 2$ , which is a square number:  $2s_1^2 + 3s_1 - 2 = s_2^2$  (=  $k\bar{a}va 1$ ). Multiplied by 8 and increased by 9,  $(4s_1 + 3)^2 = 8s_2^2 + 25$ . The second side is solved by varga-prakṛti: VP (8) [5, 15, 25], VP (8) [175, 495, 25], etc. From  $4s_1 + 3 = 15$  follows  $s_1 = 3$ ; from  $4s_1 + 3 = 495$  follows  $s_1 = 123$ ; etc. Raised by these,  $(x, y) = (s_1^2 - 2, 2s_1) = (7, 6)$ , (15127, 246), etc. (E98p1)

On assumption 2,  $x + y + 3 = (s_1 + 2)^2$ ,  $x - y + 3 = s_1^2$ ,  $x^2 + y^2 - 4 = (s_1^2 + 2s_1 + 1)^2$ ,  $x^2 - y^2 + 12 = (s_1^2 + 2s_1 - 3)^2$ , and  $xy/2 + y = (s_1 + 1)^3$ . Therefore,  $r + u + v + w + t + 2 = 2s_1^2 + 7s_1 + 3$ , which is a square number:  $2s_1^2 + 7s_1 + 3 = s_2^2$  (=  $k\bar{a}va 1$ ). Multiplied by 8 and increased by 49,  $(4s_1 + 7)^2 = 8s_2^2 + 25$ . The second side is solved by varga-prakṛti: VP (8) [5, 15, 25], VP (8) [175, 495, 25], etc. From  $4s_1 + 7 = 15$  follows  $s_1 = 2$ ; from  $4s_1 + 7 = 495$  follows  $s_1 = 122$ ; etc. Raised by these,  $(x, y) = (s_1^2 + 2s_1 - 1, 2s_1 + 2) = (7, 6)$ , (15127, 246), etc. (E98p2)

E98p3 explains the process of 'raising' for assumption 2 step by step. As this is too explanatory, E98p3, except the last sentence (evam bahudhā), may be a later interpolation.

**E99:** Two systems of quadratic equations in two main and two auxiliary unknown numbers each.

Statements of problems.

1.  $y^2 + x^2 + 1 = u^2$  and  $y^2 - x^2 + 1 = v^2$ .

2.  $y^2 + x^2 - 1 = u^2$  and  $y^2 - x^2 - 1 = v^2$ .

Solution of problem 1. Assume  $x^2 = 4s_1^2$  and  $y^2 = 5s_1^2 - 1$  ( $s_1 = y\bar{a}$  1). Then, the two statements are automatically realized. The last equation is solved by varga-prakṛti. By rule 1, VP (5) [1, 2, -1]. Also, since VP (5) [4, 9, 1], by rule 2,  $\text{BH}^+(5) \begin{bmatrix} 1 & 2 & -1 \\ 4 & 9 & 1 \end{bmatrix} = \text{VP} (5) [17, 38, -1]$ . From the first solution follows  $(x, y) = (2, 2)$ ; from the second solution follows  $(x, y) = (34, 38)$ . (E99p1)

Solution of problem 2. Assume  $x^2 = 4s_1^2$  and  $y^2 = 5s_1^2 + 1$  ( $s_1 = y\bar{a}$  1). Then, the two statements are automatically realized. The last equation is solved by varga-prakṛti. By rule 1, VP (5) [4, 9, 1]. By rule 2,  $\text{BH}^+(5) \begin{bmatrix} 4 & 9 & 1 \\ 4 & 9 & 1 \end{bmatrix} = \text{VP} (5) [72, 161, 1]$ . From the first solution follows  $(x, y) = (8, 9)$ ; from the second solution follows  $(x, y) = (144, 161)$ . (E99p2)

Assumption method 1. Assume  $x^2 = a^2s_1^2$  and  $y^2 = bs_1^2 \mp 1$  (the minus sign for problem 1 and the plus sign for problem 2). In either problem, from the two statements follow  $(b+a^2)s_1^2 = u^2$  and  $(b-a^2)s_1^2 = v^2$ . Let  $b+a^2 = k^2$  and  $b-a^2 = \ell^2$ . Then,  $2a^2 = k^2 - \ell^2 = (k+\ell)(k-\ell)$ . Let  $k-\ell = c$ . Then,  $k+\ell = 2a^2/c$ . By the rule of concurrence (L 56),  $k = (2a^2/c + c)/2$  and  $\ell = (2a^2/c - c)/2$ . Therefore, define  $b$  as  $b = k^2 - a^2 = \ell^2 + a^2$ , and  $a$  in such a way that  $b$  may be an integer. For example, if one assumes  $a^2 = 4$ , then from  $2a^2 = 8 = 2 \cdot 4$  follows  $b = 5$  (this is the case of the above two solutions); if one assumes  $a^2 = 36$ , then from  $2a^2 = 72 = 6 \cdot 12$  follows  $b = 45$ , from  $72 = 4 \cdot 18$  follows  $b = 85$ , and from  $72 = 2 \cdot 36$  follows  $b = 325$ . (E99p3–p4)

Assumption method 2. Assume  $x^2 = 2abs_1^2$  and  $y^2 = (a^2 + b^2)s_1^2 \mp 1$  (the minus sign for problem 1 and the plus sign for problem 2). Then, in either problem, the two statements are realized:  $y^2 + x^2 \pm 1 = (a+b)^2s_1^2$ ,  $y^2 - x^2 \pm 1 = (a-b)^2s_1^2$ . Therefore, assume  $a = k^2$  and  $b = \ell^2/2$  so that  $2ab$  may be a square number, and solve  $y^2 = (a^2 + b^2)s_1^2 \mp 1$  by varga-prakṛti. For example, if one assumes  $a = 1^2 = 1$  and  $b = 2^2/2 = 2$ , then  $x^2 = 4s_1^2$ ,  $y^2 = 5s_1^2 \mp 1$  (this is the case of the above two solutions); if one assumes  $a = 3^2 = 9$  and  $b = 2^2/2 = 2$ , then  $x^2 = 36s_1^2$ ,  $y^2 = 85s_1^2 \mp 1$ . (E 99p5)

In L 60–61, Bhāskara gives two algorithms for problem 2 of BG E99.

#### 84–85: Rule 7.

1. Type  $as_1 + b = s_2^2$ . (1a) If there is no other statement, assume  $s_2$  to be a known number ( $c$ ) to obtain  $s_1$ :  $s_1 = (c^2 - b)/a$ . (1b) If there is another statement, assume  $s_2 = cs_3 + d$ , obtain an evaluation of  $s_1$ ,  $s_1 = (c^2/a)s_3^2 + (2cd/a)s_3 + (d^2 - b)/a$ , and to this apply that statement.

2. Type  $as_1 + b = s_2^3$ . Do in the same way as above.

**E100:** A system of quadratic equations in one main and two auxiliary unknown numbers.

Statements of problem.  $3x + 1 = u^2$  and  $5x + 1 = v^2$ .

Solution 1. Let  $x = s_1 (= y\bar{a} 1)$ , and  $u = s_2 (= k\bar{a} 1)$ . Then, from the first statement follows the equation,  $3s_1 + 1 = s_2^2$ . Let  $s_2 = 3s_3 + 1$  ( $s_3 = n\bar{i} 1$ ). Then,  $3s_1 + 1 = (3s_3 + 1)^2 = 9s_3^2 + 6s_3 + 1$ , from which follows an evaluation of  $s_1$ :  $s_1 = 3s_3^2 + 2s_3$ . To this apply the second statement:  $5(3s_3^2 + 2s_3) + 1 = s_4^2$  ( $s_4 = p\bar{i} 1$ ), or  $15s_3^2 + 10s_3 = s_4^2 - 1$ . Multiplied by 15 and increased by 25,  $(15s_3 + 5)^2 = 15s_4^2 + 10$ . The second side is solved by varga-prakṛti. By rule 1, VP (15) [1, 5, 10]. Since VP (15) [1, 4, 1], by rule 2, BH<sup>+</sup>(15)  $\begin{bmatrix} 1 & 5 & 10 \\ 1 & 4 & 1 \end{bmatrix} = \text{VP (15) [9, 35, 10]}$ . Again by rule 2, BH<sup>+</sup>(15)  $\begin{bmatrix} 9 & 35 & 10 \\ 1 & 4 & 1 \end{bmatrix} = \text{VP (15) [71, 275, 10]}$ . When  $s_4 = 9$ , from  $15s_3 + 5 = 35$  follows  $s_3 = 2$ , and  $s_1 = 3s_3^2 + 2s_3 = 16 (= x)$ ; when  $s_4 = 71$ , from  $15s_3 + 5 = 275$  follows  $s_3 = 18$ , and  $s_1 = 3s_3^2 + 2s_3 = 1008 (= x)$ . (E100p1)

Solution 2. Let  $x = \frac{1}{3}s_1^2 - \frac{1}{3}$  ( $s_1 = y\bar{a} 1$ ). Then, the first statement is automatically realized:  $3x + 1 = s_1^2$  ( $u = s_1$ ). From the second statement,  $\frac{5}{3}s_1^2 - \frac{2}{3} = s_2^2$  ( $v = s_2 = k\bar{a} 1$ ). This is solved by varga-prakṛti. By rule 1, VP (5/3) [1, 1, -2/3], Since VP (5/3) [3, 4, 1], by rule 2, VP (5/3) [7, 9, -2/3]. Again by rule 2, VP (5/3) [55, 71, -2/3]. That is,  $(s_1, s_2) = (7, 9)$  and  $(55, 71)$ . Therefore,  $x = \frac{1}{3}s_1^2 - \frac{1}{3} = 16$  and  $1008$ . (E100p2)

**E101:** A system of cubic equations in one main and two auxiliary unknown numbers.

Statements of problem.  $3x + 1 = u^3$  and  $3u^2 + 1 = v^2$ .

Solution. Let  $x = s_1 (= y\bar{a} 1)$  and  $u = s_2 (= k\bar{a} 1)$ . Then, from the first statement an evaluation of  $s_1$  is obtained:  $s_1 = \frac{1}{3}s_2^3 - \frac{1}{3}$ . Let  $v = s_3 (= n\bar{i} 1)$ . Then, from the second statement follows the equation,  $3s_2^2 + 1 = s_3^2$ . This is solved by varga-prakṛti: VP (3) [ $s_2, s_3, 1$ ]. By rule 1, VP (3) [1, 2, 1]. By rule 2, VP (3) [4, 7, 1]. Again by rule 2, VP (3) [15, 26, 1]. When  $s_2 = 4$ ,  $s_1 = 21 (= x)$ ; when  $s_2 = 15$ ,  $s_1 = 3374/3 (= x)$ .

**E102:** A system of quadratic equations in two main and two auxiliary unknown numbers.

Statements of problem.  $2(x^2 - y^2) + 3 = u^2$  and  $3(x^2 - y^2) + 3 = v^2$ .

This is solved after the next meta-rule.

**86:** A meta-rule on the starting point of calculation.

‘The learned begin calculation sometimes from its beginning, sometimes from its middle, and sometimes from its end so that the calculation may become easier and may be accomplished.’

Solution of E102. Let  $x^2 - y^2 = s_1 (= y\bar{a} 1)$  and  $u = s_2 (= k\bar{a} 1)$ . Then, from the first statement,  $2s_1 + 3 = s_2^2$ , from which an evaluation of  $s_1$  is obtained:  $s_1 = \frac{1}{2}s_2^2 - \frac{3}{2}$ . Let  $v = s_3 (= n\bar{i} 1)$ . Then, from the second statement,  $\frac{3}{2}s_2^2 - \frac{3}{2} = s_3^2$ . By the equal subtraction etc.,  $3s_2^2 = 2s_3^2 + 3$ . Multiplied by 3,  $(3s_2)^2 = 6s_3^2 + 9$ . This is solved by varga-prakṛti, VP (6) [ $s_3, 3s_2, 9$ ]: VP (6) [6, 15, 9] and VP (6) [60, 147, 9]. If  $3s_2 = 15$ , then  $s_2 = 5$  and  $s_1 = \frac{1}{2}s_2^2 - \frac{3}{2} = 11$ . If  $3s_2 = 147$ , then  $s_2 = 49$  and  $s_1 = 1199$ . Therefore, let  $x^2 - y^2 = s_1 = 11$ . Then, if  $x - y = 1$ , then  $x + y = 11$

and, by the rule of concurrence (L 56),  $(x, y) = (6, 5)$ . ( $x - y = 11$  would bring the negative solution,  $y = -5$ , which is not acceptable.) Let  $x^2 - y^2 = s_1 = 1199$ . Then, if  $x - y = 1$ , then  $x + y = 1199$  and  $(x, y) = (600, 599)$ ; if  $x - y = 11$ , then  $x + y = 109$  and  $(x, y) = (60, 49)$ .

**87:** Rule 8. Square-kuttaka etc. 1.

Type  $(x^n + c)/b = u$ , where  $n \geq 2$  and  $x$  and  $u$  are integers.

When  $n = 2$ , let  $x = s_1$  and  $u = s_2$ . Then,  $s_1^2 = bs_2 - c$ . Equate the second side to  $(ks_3 + d)^2$ . Then  $s_2 = k^2bs_3^2 + 2kds_3 + (d^2 + c)/b$ . Take such  $d$  that makes  $s_2$  an integer.

**E103:** Two indeterminate quadratic equations in one main and one auxiliary unknown numbers each.

Statements of problems. 1.  $(x^2 - 4)/7 = u$ . 2.  $(x^2 - 30)/7 = u$ .

Solution of 1. Let  $x = s_1$  ( $= y\bar{a} 1$ ) and  $u = s_2$  ( $= k\bar{a} 1$ ). Then,  $s_1^2 = 7s_2 + 4$ . Equate the second side to  $(7s_3 + 2)^2$  ( $s_3 = n\bar{i} 1$ ). Then,  $s_2 = 7s_3^2 + 4s_3$ , which means that  $s_2$  ( $= u$ ) is an integer for any integer  $s_3$ . Therefore, if  $s_3 = 1$ , then  $s_1 = 7s_3 + 2 = 9$  and  $x^2 = s_1^2 = 81$ .

Solution of 2 is given after the next rule.

**88–90:** Rule 9. Square-kuttaka etc. 2.

1. Type  $(x^2 \pm c)/b = u$ . Let  $x = s_1$  ( $= y\bar{a} 1$ ) and  $u = s_2$  ( $= k\bar{a} 1$ ). Then,  $s_1^2 = bs_2 \mp c$ .

1a. When  $s_1^2 = bs_2 + c$  and  $\sqrt{c}$  is an integer (say,  $d$ ), take such  $p$  that satisfies  $p^2 = bq_1$  and  $2pd = bq_2$ , and let the second side be  $(ps_3 \pm d)^2$ . Then,  $s_2 = q_1s_3^2 \pm q_2s_3$ , which means that  $s_2$  is an integer for any integer  $s_3$ . Hence follow solutions,  $(u, x) = (q_1s_3^2 \pm q_2s_3, ps_3 \pm d)$ .

1b. When  $s_1^2 = bs_2 + c$  and  $\sqrt{c}$  is not an integer, (or when  $s_1^2 = bs_2 - c$ ),  $c$  is pared by  $b$ :  $c = bq + r$  ( $0 \leq r < b$ ). If there exist such  $m$  and  $d$  that  $r + mb = d^2 = c'$ , then  $c = bq - mb + c'$  and therefore  $u = (x^2 - c)/b = (x^2 - c')/b - (q - m)$ , or  $(x^2 - c')/b = u + (q - m) = u'$ . To this apply the rule of 1a and obtain  $(u', x)$ . If there do not exist such  $m$  and  $d$ , then 'the example is barren (khila).'

2. Type  $(ax^2 \pm c)/b = u$ . Let  $x = s_1$  ( $= y\bar{a} 1$ ) and  $u = s_2$  ( $= k\bar{a} 1$ ). Then,  $as_1^2 = bs_2 \mp c$ . Multiplied by such  $k$  that makes  $ka$  a square number (say,  $a'^2$ ),  $(a's_1)^2 = b(ks_2) \mp kc$ . To this apply the rule of 1.

The following are additional rules given in 90p2.

3. Type  $(x^3 \pm c)/b = u$ . This is solved also by the rule of 1. Let  $x = s_1$  ( $= y\bar{a} 1$ ) and  $u = s_2$  ( $= k\bar{a} 1$ ). Then,  $s_1^3 = bs_2 \mp c$ .

3a. When  $\sqrt[3]{c}$  is an integer (say,  $d$ ), take such  $p$  that  $p^3 = bq_1$  and  $3pd = bq_2$ , and let the second side be  $(ps_3 \mp d)^3$ . The rest is the same as 1a.

3b. When  $\sqrt[3]{c}$  is not an integer,  $c$  is pared by  $b$ :  $c = bq + r$  ( $0 \leq r < b$ ). If there



exist such  $m$  and  $d$  that  $r + mb = d^3 = c'$ , then  $c = bq - mb + c'$ . The rest is the same as 3a. If there do not exist such  $m$  and  $d$ , then 'the example is barren.'

4. Type  $(ax^3 \pm c)/b = u$ . This case is only vaguely referred to by Bhāskara in his statement that the last statement of 3b (if ... barren) 'should also be applied ahead' (agre 'pi yojyam). The first step of the procedure for this type must be the same as 2; that is, both sides of  $as_1^3 = bs_2 \mp c$  are multiplied by such  $k$  that makes  $ka$  a cubic number (say,  $a'^3$ ):  $(a's_1)^3 = b(ks_2) \mp kc$ . The rest is the same as 3.

Solution of E103.2. Let  $x = s_1 (= y\bar{a} 1)$  and  $u = s_2 (= k\bar{a} 1)$ . Then,  $s_1^3 = 7s_2 + 30$ . As this 30 does not have an integer root, it is pared by the divisor 7:  $30 = 7 \cdot 4 + 2$ . The resulting 2, increased twice by the divisor 7, is 16, a square number:  $2 + 7 \cdot 2 = 16 = 4^2$ . Equate the second side to  $(7s_3 \pm 4)^2$ . Then,  $s_2 = 7s_3^2 \pm 8s_3 - 2$ . This  $s_2$  is an integer for any integer  $s_3$ . Hence follow solutions,  $(u, x) = (7s_3^2 \pm 8s_3 - 2, 7s_3 \pm 4)$ . (90p3)

**E104:** An indeterminate cubic equation in one main and one auxiliary unknown numbers.

Statement of problem.  $(x^3 - 6)/5 = u$ .

Solution. Let  $x = s_1 (= y\bar{a} 1)$  and  $u = s_2 (= k\bar{a} 1)$ . Then,  $s_1^3 = 5s_2 + 6$ , whose second side is equated to  $(5s_3 + 6)^3$  ( $s_3 = n\bar{1} 1$ ). Then, from  $s_1^3 = 125s_3^3 + 450s_3^2 + 540s_3 + 216 = 5s_2 + 6$  follows  $s_2 = 25s_3^3 + 90s_3^2 + 108s_3 + 42$ . This  $s_2$  is an integer for any integer  $s_3$ . Hence follow the solutions,  $x = s_1 = 5s_3 + 6$ . For example, when  $s_3 = 0$ ,  $(x, u) = (6, 42)$ ; when  $s_3 = 1$ ,  $(x, u) = (11, 265)$ .

**E105:** An indeterminate quadratic equation in one main and one auxiliary unknown numbers.

Statement of problem.  $(5x^2 + 3)/16 = u$ .

Solution. Let  $x = s_1 (= y\bar{a} 1)$  and  $u = s_2 (= k\bar{a} 1)$ . Then,  $5s_1^2 = 16s_2 - 3$ . Multiplied by 5,  $(5s_1)^2 = 16(5s_2) - 15$ . Substitute  $s_2$  for  $5s_2$ :  $(5s_1)^2 = 16s_2 - 15$ . Equate the second side to  $(8s_3 + 1)^2$  ( $s_3 = n\bar{1} 1$ ). Then,  $s_2 = 4s_3^2 + s_3 + 1$ . This  $s_2$  is an integer for any integer  $s_3$ . Solving  $5s_1 = 8s_3 + 1$  by kuṭṭaka, KU (8, 5, 1) [5, 3]. That is,  $(s_1, s_3) = (8s_4 + 5, 5s_4 + 3)$  ( $s_4 = p\bar{1} 1$ ). When  $(s_4 = 0, x = s_1 = 5; \text{ when } s_4 = 1, x = s_1 = 13)$ . (E105p1)

Or, otherwise, equate the second side to  $(8s_3 - 1)^2$  ( $s_3 = n\bar{1} 1$ ). Then,  $s_2 = 4s_3^2 - s_3 + 1$ . This  $s_2$  is an integer for any integer  $s_3$ . Solve  $5s_1 = 8s_3 - 1$  by kuṭṭaka: KU (8, 5, -1) [3, 2]. That is,  $(s_1, s_3) = (8s_4 + 3, 5s_4 + 2)$  ( $s_4 = p\bar{1} 1$ ). (E105p2)

### III.1.11 Chapter 11: Bhāvita

**91:** Rule 1 for bhāvita equations.

If an equation contains a bhāvita or product of two or more colors, then optionally assume a known number for each of them except one, and apply the first seed (BG 56–58).

**E106:** An indeterminate bhāvita equation in two unknown numbers.

Statement of problem.  $xy = 4x + 3y + 2$ .

Solution. Let  $x = s_1 (= yā 1)$  and  $y = s_2 (= kā 1)$ . Then,  $s_1s_2 = 4s_1 + 3s_2 + 2$ . If one assumes  $s_2 = 5$ , then  $5s_1 = 4s_1 + 17$ . By the equal subtraction,  $s_1 = 17$ . Raised by this,  $(x, y) = (17, 5)$ . If one assumes  $s_2 = 6$ , then  $(x, y) = (10, 6)$ . Likewise, there are infinite solutions according to the optional numbers.

**E107:** An indeterminate bhāvita equation in four unknown numbers.

Statement of problem.  $20(x_1 + x_2 + x_3 + x_4) = x_1x_2x_3x_4$ .

Solution. Let  $x_1 = s_1 (= yā 1)$ , and assume  $x_2 = 5$ ,  $x_3 = 4$ , and  $x_4 = 2$ . Then,  $\langle$ from  $20(s_1 + 11) = 40s_1$  follows $\rangle$   $s_1 = 11$ . Therefore,  $(x_1, x_2, x_3, x_4) = (11, 5, 4, 2)$ . Or, otherwise, assume  $x_2 = 10$ ,  $x_3 = 3$ , and  $x_4 = 1$ . Then,  $\langle$ from  $20(s_1 + 14) = 30s_1$  follows $\rangle$   $s_1 = 28$ . Therefore,  $(x_1, x_2, x_3, x_4) = (28, 10, 3, 1)$ . Or, otherwise, assume  $x_2 = 6$ ,  $x_3 = 4$ , and  $x_4 = 1$ . Then,  $\langle$ from  $20(s_1 + 11) = 24s_1$  follows $\rangle$   $s_1 = 55$ . Therefore,  $(x_1, x_2, x_3, x_4) = (55, 6, 4, 1)$ . Or, otherwise, assume  $x_2 = 8$ ,  $x_3 = 3$ , and  $x_4 = 1$ . Then,  $\langle$ from  $20(s_1 + 12) = 24s_1$  follows $\rangle$   $s_1 = 60$ . Therefore,  $(x_1, x_2, x_3, x_4) = (60, 8, 3, 1)$ . There are many solutions.

**E108:** Two indeterminate bhāvita equations in two main and one auxiliary unknown numbers each.

Statements of problems.

1.  $x + y + xy + x^2 + y^2 = u^2$  and  $x + y + u = 23$ .
2.  $x + y + xy + x^2 + y^2 = u^2$  and  $x + y + u = 53$ .

Solution of 1. Let  $x = s_1 (= yā 1)$ , and assume  $y = 2$ . Then, from the first statement follows  $u^2 = x + y + xy + x^2 + y^2 = s_1^2 + 3s_1 + 6$ , and from the second statement  $u^2 = \{23 - (x + y)\}^2 = (21 - s_1)^2 = s_1^2 - 42s_1 + 441$ . Therefore,  $s_1^2 + 3s_1 + 6 = s_1^2 - 42s_1 + 441$ . By the equal subtraction,  $45s_1 = 435$ , from which follows  $s_1 = 29/3$ . Therefore,  $(x, y) = (29/3, 2)$ . Or, otherwise, assume  $y = 3$ . Then  $(x, y) = (97/11, 3)$ . Or, otherwise, assume  $y = 5$ . Then,  $(x, y) = (7, 5)$ . (E108p1)

Solution of 2. Let  $x = s_1 (= yā 1)$ , and assume  $y = 2$ . Then,  $s_1^2 + 3s_1 + 6 = s_1^2 - 102s_1 + 2601$ . By the equal subtraction,  $105s_1 = 2595$ , from which follows  $s_1 = 173/7$ . Therefore,  $(x, y) = (173/7, 2)$ . Or, otherwise, assume  $y = 17$ . Then,  $(x, y) = (11, 17)$ . (E108p2)

At the end of solution 2 (E108p2) Bhāskra remarks that it is not easy to get integer solutions by rule 1, i.e., by assuming a known number for one of the two unknown numbers, and gives another rule in the next two verses.

**92–93:** Rule 2 for bhāvita equations in two unknown numbers.

1. Subtract bhāvitās from one side and the two colors and the rūpas from the other side. Divide both sides by the digit (i.e., coefficient) of the bhāvita to obtain the equation,  $xy = ax + by + c$ .

2. Optionally factorize  $(ab + c)$ , i.e., choose such  $p$  and  $q$  that satisfy  $ab + c = pq$ . Then,  $(x, y) = (b \pm p, a \pm q)$  and  $(b \pm q, a \pm p)$  are solutions.

After illustrating this rule with the example of E106 in 93p2, Bhāskara gives two proofs of the rule, one based on figures (kṣetra-gata) in 93p3 and the other based on quantities (rāśi-gata) in 93p4. He maintains that the proof (upapatti) is of those two kinds everywhere (sā ca dvidhā sarvatra syāt/ ekā kṣetragatānyā rāśigateti, 93p3).

**Q12=E106:**  $xy = 4x + 3y + 2$ .

Solution of E106 according to rule 2.  $ab + c = 4 \times 3 + 2 = 14$ . From the factorization,  $14 = 1 \times 14$ , follow  $(x, y) = (3 + 1, 4 + 14) = (4, 18)$  and  $(x, y) = (3 + 14, 4 + 1) = (17, 5)$ . Also, from the factorization,  $14 = 2 \times 7$ , follow  $(x, y) = (3 + 2, 4 + 7) = (5, 11)$  and  $(x, y) = (3 + 7, 4 + 2) = (10, 6)$ . (BG 93p2)

Proof of rule 2 based on figures. Bhāskara uses the notation of E106 for the proof, that is, yā 1 and kā 1 for the two unknown numbers, and 4, 3, and 2 for the three known numbers, but I use  $s_1$  and  $s_2$  for the two unknown numbers, and  $a$ ,  $b$ , and  $c$  for the three known numbers. Regard  $s_1$  and  $s_2$  in the equation,  $s_1 s_2 = as_1 + bs_2 + c$ , as the numbers of unit squares on the two orthogonal sides (called ‘arm’ and ‘edge’) of a rectangle, which Bhāskara calls bhāvita figure (see the first figure in 93p3). Then the bhāvita figure, whose area is  $s_1 s_2$ , consists of  $a$  of  $s_1$ ,  $b$  of  $s_2$ , and  $c$  rūpas (unit squares). If one removes  $as_1 + b(s_2 - a)$  from the bhāvita figure, then a small rectangle remains on the bottom left corner (see the second figure in 93p3). If, on the other hand, one subtracts the same,  $as_1 + b(s_2 - a)$ , from both sides of the equation, one obtains  $s_1 s_2 - \{as_1 + b(s_2 - a)\} = as_1 + bs_2 + c - \{as_1 + b(s_2 - a)\} = (ab + c)$ . This is the area of the small rectangle. If, therefore, one regards its two orthogonal sides as consisting of  $p$  and  $q$  unit squares, respectively, then  $ab + c = pq$ , and  $(x, y) = (s_1, s_2) = (b + p, a + q)$  or  $(b + q, a + p)$ . (BG 93p3)

Proof of rule 2 based on quantities. Let the two orthogonal sides of the small rectangle be  $s_3 (= nī 1)$  and  $s_4 (= pī 1)$ . Then,  $(s_1, s_2) = (b + s_4, a + s_3)$  or  $(b + s_3, a + s_4)$ . Raised by these, the first side of the equation is  $(ab + as_4 + bs_3 + s_3 s_4)$ , and the second side  $(ab + as_4 + ab + bs_3 + c)$ . By the equal subtraction,  $s_3 s_4 = ab + c$ . The rest of the proof is the same as above. (BG 93p4)

After the next verse on the affiliation of proof, Bhāskara explains in 93p5 two more possible layouts of the bhāvita figure and the rectangle  $s_3 s_4$ , the second case of which corresponds to the negative sign of the solutions by rule 2.

**94:** Affiliation of proof.

‘Calculators say that bīja-gaṇita is accompanied by proof. For, otherwise, there would be no difference between pāṭī and bīja.’

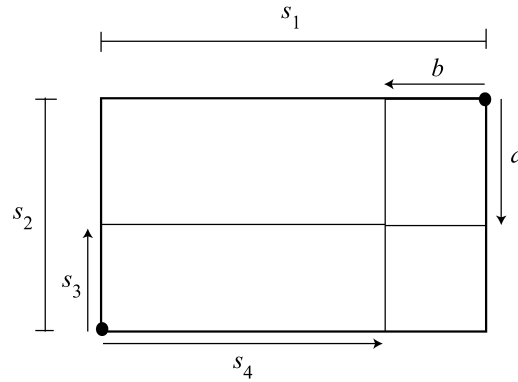
Two more layouts of the bhāvita figure  $s_1 s_2$  and the rectangle  $s_3 s_4$ .

1. If  $a < 0$ ,  $b < 0$ , and  $c > 0$ , then the bhāvita figure  $s_1s_2$  is included in the rectangle  $s_3s_4$  (see the first figure in 93p5).

2. If  $a > s_2 > 0$  and  $b > s_1 > 0$ , then  $s_3 < 0$  and  $s_4 < 0$ , and the rectangle  $ab$  consists of the bhāvita figure  $s_1s_2$  and three rectangles,  $s_3s_4$ ,  $s_1(a - s_2)$ , and  $(b - s_1)s_2$ . In this case, the bhāvita figure  $s_1s_2$  touches the rectangle  $s_3s_4$  from outside only at a corner (see the second figure in 93p5). (BG 93p5)

Note that the last three figures (the second figure in 93p3 and the two figures in 93p5) illustrate the following three cases, respectively, under the conditions,  $s_1 = s_4 + b > 0$  and  $s_2 = s_3 + a > 0$ .

- (1)  $0 < a < s_2$  and  $0 < b < s_1$ ;
- (2)  $a < 0$  and  $b < 0$ ; and
- (3)  $a > s_2$  and  $b > s_1$  (that is,  $s_3 < 0$  and  $s_4 < 0$ ).



The above figure interprets the first case (cf. the second figure in 93p3): the four arrows indicate the positive directions of  $a$ ,  $b$ ,  $s_3$ , and  $s_4$ . When they are negative, they point to the opposite directions as  $a$  and  $b$  in the second case (cf. the first figure in 93p5) and  $s_3$  and  $s_4$  in the third case (cf. the second figure in 93p5) do. This is the way Bhāskara explained negative lengths in the L as well. In his prose comment on L 168, he calculates the two segments of the base 9 of the trilateral (9, 10, 17) by means of his own rule. He says, ‘Here, what is obtained by means of “The sum of the two sides of a trilateral” etc. (L 165–166) is 21. The base (9) cannot be diminished by this (21). From this the base should be subtracted and half the remainder is a negative segment (ṛṇagatābādḥā) (−6), which means ⟨a segment⟩ in the opposite direction (digvaiparītyena).’

**E109:** An indeterminate bhāvita equation in two unknown numbers.

Statement of problem.  $2xy = 10x + 14y - 58$ .

Solution. Let  $x = s_1$  ( $=yā$  1) and  $y = s_2$  ( $=kā$  1). According to rule 2, divide both sides by the coefficient of the bhāvita:  $s_1s_2 = 5s_1 + 7s_2 - 29$ . Therefore,  $ab + c = 5 \times 7 - 29 = 6$ . From the factorization,  $6 = 2 \times 3$ , follow  $(x, y) = (7+3, 5+2) = (10, 7)$ ,  $(7+2, 5+3) = (9, 8)$ ,  $(7-3, 5-2) = (4, 3)$ , and  $(7-2, 5-3) = (5, 2)$ .

**E110:** An indeterminate bhāvita equation in two unknown numbers.

Statement of problem.  $xy + 3x + 5y = 62$ .

Solution. Let  $x = s_1$  ( $=yā 1$ ) and  $y = s_2$  ( $=kā 1$ ). Then, by rule 2,  $s_1s_1 = -3s_1 - 5s_2 + 62$ , and therefore  $ab + c = (-3) \times (-5) + 62 = 77$ . From the factorization,  $77 = 7 \times 11$ , follow  $(x, y) = (-5 + 11, -3 + 7) = (6, 4)$ ,  $(-5 + 7, -3 + 11) = (2, 8)$ ,  $(x, y) = (-5 - 11, -3 - 7) = (-16, -10)$ , and  $(-5 - 7, -3 - 11) = (-12, -14)$ . The negative solutions are not accepted.

**Q13=E108.1:**  $x + y + xy + x^2 + y^2 = u^2$  and  $x + y + u = 23$ .

Solution by rule 2. Let  $x = s_1$  ( $=yā 1$ ) and  $y = s_2$  ( $=kā 1$ ). Then,  $x + y + xy + x^2 + y^2 = s_1 + s_2 + s_1s_2 + s_1^2 + s_2^2$ . 'As this has no root' (asya mūla-abhāvāt), equate it to  $\{23 - (x + y)\}^2 = s_1^2 + s_2^2 + 2s_1s_2 - 46s_1 - 46s_2 + 529$ , make the equal subtraction, and divide both sides by the coefficient of the bhāvita:  $s_1s_2 = 47s_1 + 47s_2 - 529$ . Hence follows  $ab + c = 47 \times 47 - 529 = 1680$ . From the factorization,  $1680 = 40 \times 42$ , follow  $(x, y) = (47 - 40, 47 - 42) = (7, 5)$  (or  $(5, 7)$ ) and  $(47 + 40, 47 + 42) = (87, 89)$ , the latter of which is inappropriate (it is a solution of  $x + y - u = 23$ ).

**Q14=E108.2:**  $x + y + xy + x^2 + y^2 = u^2$  and  $x + y + u = 53$ .

Solution by rule 2. In exactly the same way as above,  $s_1s_2 = 107s_1 + 107s_2 - 2809$ . Hence follows  $ab + c = 107 \times 107 - 2809 = 8640$ . From the factorization,  $8640 = 90 \times 96$ , follow  $(x, y) = (107 - 96, 107 - 90) = (11, 17)$  (or  $(17, 11)$ ) and  $(107 + 96, 107 + 90) = (203, 197)$ , the latter of which is inappropriate (it is a solution of  $x + y - u = 53$ ).

E110p4 refers to a system of simultaneous bhāvita equations, where more than one equation contains a bhāvita or bhāvitās. In that case, new equations are to be obtained from evaluations (unmiti) of the bhāvitās.

### III.1.12 Chapter 12: Epilogue

**95:** Father.

Bhāskra refers to his father, Maheśvara, who initiated him into mathematics.

**96:** Predecessors.

Bhāskara mentions his predecessors, Brahmagupta, Śrīdhara, and Padmanābha, who wrote copious books on bīja-gaṇita. Taking the essence of their works, he says, he made a small book with correct reasoning in order to satisfy pupils.

**97ab:** Size of this book.

According to Bhāskra, the size of this book, consisting of rules and examples, is 1,000 anuṣṭubhs, that is,  $1,000 \text{ anuṣṭubhs} \times 32 \text{ syllables/anuṣṭubh} = 32,000$  syllables (or syllabic letters), but this number does not agree with my counting of the syllables that compose the present edition as the table below shows.

IA1, IC1, IIA1, and IIE1 include the number of the syllables in Chapter 12,

which is indicated in the parentheses. Obviously, the number of the syllables of the verses for the rules (IA1) and for the examples (IB1) is too small: IA1 + AB1 = 8,766 syllables = 273.9 anuṣṭubhs. But, if we add the syllables of the prose paragraphs (IIB1) to them, the sum exceeds that number by 3,662 syllables, i.e., by 11.4% (10.4% if we exclude Chapter 12): IA1 + AB1 + IIB1 = 35,662 syllables = 1,114.4 anuṣṭubhs. This may suggest that the present *Bījaganīta* contains later interpolations. See E12p5, E15p3, E64p1–p3, E98p3, and 101p.

		1: Syllables	2: Numerals
I (verse)	A: BG 1–102	4,124 (320)	0
	B: BG E1–E110	4,642	0
	C: BG Q1–Q15	414 (32)	0
II (prose)	A: Introductory phrases	1,523 (41)	0
	B: Prose paragraphs	26,896	3,878
	C: Displayed matters	674	834
	D: Figures	54	184
	E: Ending remarks	382 (23)	0

**97cd–98:** Aims of multiple examples.

The reason why the author gave more than one example for a single rule and one and the same example at more than one place is to show (1) the object area (artha-viṣaya) of a rule, (2) the validity (vyāpti) of a rule or of a thesis, (3) different assumptions or settings (kalpanā-bheda), and (4) the reasoning (yukti). But only a limited number of examples are given in this book because examples are endless.

According to Kṛṣṇa, the following examples are designed for the above aims: (1) Q12 (=E106), E109, E110, Q13 (=E108.1), and Q14 (=E108.2) for rule 2 for bhāvita equations given in BG 92–93; (2) E43, in addition to E42, for the validity of the easiness of the algorithm given in E42p2; (3) E39=Q9 (E38=Q8 also); and (4) many examples (he does not specify).

**99–100:** Copious books unnecessary.

A copious treatise is a vast ocean which is difficult for less intelligent people to cross over. It is useless, on the other hand, for intelligent people, for whom a fraction of instruction makes a treatise, that is to say, it spreads by itself once it reaches them, (as the following maxim suggests.)

**101=CV 14.5:** A maxim on the innate power.

‘Oil to water, a secret to a wicked person, an offering to a bowl, and a treatise to a wise person: they spread themselves by means of their own innate power (once they reached their targets), however small fractions they might be.’

This is a maxim belonging to the *Vṛddhacāṇakya* (CV 14.5), the best-known

among the six versions of the aphorism collections attributed to Cāṇakya. See CNTT vol. 1, pt. 1, p. 82; and vol. 2, pt. 2, pp. 245–246.

**Q15=GA praśna 3:** Characterization of pāṭī-gaṇita and bīja-gaṇita.

pāṭī-gaṇita = trairāśika or three-quantity operation

bīja-gaṇita = vimala-mati or stainless intelligence

**102:** Merits of this book.

‘This book is pleasant for reciting (reading), is easy to understand even for young people, is the essence of the whole mathematics, and is accompanied by proof methods. In short, this book is full of merits and free from faults. Read, calculator, this small book in order to enhance your intelligence and to obtain maturity.’

### III.2 Classified List of Algebraic Problems in the *Bījagaṇita*

Here I give a classified list of the algebraic problems that were solved by Bhāskara in the *Bījagaṇita*. The classification was first made according to the highest order of the equations of each problem: linear, quadratic, cubic, and bi-quadratic. Then, in each category, a problem, which consists of an equation or of a system of equations, is listed according to the numbers of the unknown numbers whose values are required (*a*), of the unknown numbers whose values are not required (*b*), and of the equations in the problem (*c*). I indicate them by [*a, b, c*] in the subheadings of the list that follows. As in Appendix 1, here also I express the equations in modern algebraic notation, as close to the expression of the Sanskrit verses as possible, but the implicit equations such as  $x^2 + y^2 = z^2$  of the Pythagorean theorem, which were put in a pair of angular parentheses in Appendix 1, are here listed without them.

#### III.2.1. Linear Equations

[1, 0, 1]

$$x/5 + x/3 + 3(x/3 - x/5) + 1 = x$$

..... E41

$$\begin{cases} 6x + 300 = u_1 \\ 10x - 100 = u_2 \quad \dots\dots\dots \text{E36-37.3} \\ u_1 = 3u_2 \end{cases}$$

[1, 1, 2]

$$\begin{cases} u = 5 \cdot 12 \cdot x/100 \\ x + u = 2x - 16 \quad \dots\dots\dots \text{E45} \end{cases}$$

$$\begin{cases} (x - 10) \times 2 - 10 - 10 = u_1 \\ (u_1 - 10) \times 2 - 10 - 10 = u_2 \\ (u_2 - 10) \times 2 - 10 - 10 = u_3 \\ u_3 = 3x \end{cases}$$

..... E47

[1, 2, 2]

$$\begin{cases} 5x = 63q_1 + 7 \\ 10x = 63q_2 + 14 \quad \dots\dots\dots \text{E27} \end{cases}$$

[1, 4, 3]

$$\begin{cases} 5x = 13q + r \\ x + q = 30 \quad \dots\dots\dots \text{E87} \\ 0 \leq r < 13 \end{cases}$$

$$\begin{cases} 9x = 30q_1 + r_1 \\ 7x = 30q_2 + r_2 \\ q_1 + q_2 + r_1 + r_2 = 26 \quad \dots\dots\dots \text{E84} \\ 0 \leq r_1, r_2 < 30 \end{cases}$$

[1, 2, 3]

$$\begin{cases} 6x + 300 = u_1 \\ 10x - 100 = u_2 \quad \dots\dots\dots \text{E36-37.1} \\ u_1 = u_2 \end{cases}$$

$$\begin{cases} 23x = 60q_1 + r_1 \\ 23x = 80q_2 + r_2 \\ r_1 + r_2 = 100 \quad \dots\dots\dots \text{E86} \\ 0 \leq r_1 < 60, 0 \leq r_2 < 80 \end{cases}$$

$$\begin{cases} 6x + 300 = u_1 \\ 10x - 100 = u_2 \quad \dots\dots\dots \text{E36-37.2} \\ u_1/2 + 2 = u_2 \end{cases}$$



[1, 4, 4]

$$\begin{cases} x = 6q_1 + 5 \\ x = 5q_2 + 4 \\ x = 4q_3 + 3 \\ x = 3q_4 + 2 \end{cases} \dots\dots\dots \text{E80}$$

[1, 6, 4]

$$\begin{cases} 3x = 30q_1 + r_1 \\ 7x = 30q_2 + r_2 \\ 9x = 30q_3 + r_3 \\ r_1 + r_2 + r_3 = 30q_4 + 11 \\ 0 \leq r_1, r_2, r_3 < 30 \end{cases} \dots\dots\dots \text{E85}$$

[1, 6, 6]

$$\begin{cases} x = 2q_1 + 1, q_1 = 2q_4 + 1 \\ x = 3q_2 + 2, q_2 = 3q_5 + 2 \\ x = 5q_3 + 3, q_3 = 5q_6 + 3 \end{cases} \dots\dots\dots \text{E82}$$

[2, 0, 1]

$y = (221x + 65)/195 \dots\dots\dots \text{E21}$

$y = (100x \pm 90)/63 \dots\dots\dots \text{E22}$

$y = (-60x \pm 3)/13 \dots\dots\dots \text{E23}$

$y = (18x \pm 10)/(-11) \dots\dots\dots \text{E24}$

$y = (5x \pm 23)/3 \dots\dots\dots \text{E25}$

$y = 5x/13 \dots\dots\dots \text{E26.1}$

$y = (5x + 65)/13 \dots\dots\dots \text{E26.2}$

[2, 0, 2]

$$\begin{cases} x_1 + 100 = 2(x_2 - 100) \\ 6(x_1 - 10) = x_2 + 10 \end{cases} \dots\dots\dots \text{E39, Q9}$$

[2, 6, 3]

$$\begin{cases} 6x = yq_1 + r_1 \\ 8x = yq_2 + r_2 \\ 100x = yq_3 + r_3 \\ 0 \leq r_1, r_2, r_3 < y \end{cases} \dots\dots\dots \text{E88}$$

[3, 0, 5]

$$\begin{cases} x_1 + x_1/2 = x_2 + x_2/5 = x_3 + x_3/9 \\ x_1 - x_2/5 - x_3/9 = 60 \\ x_2 - x_1/2 - x_3/9 = 60 \\ x_3 - x_1/2 - x_2/5 = 60 \end{cases} \dots\dots\dots \text{E49}$$

[3, 1, 4]

$$\begin{cases} 8x_1 = u, 10x_2 = u, 100x_3 = u \\ x_1 + x_2 + x_3 = 47 \end{cases} \dots\dots\dots \text{E40}$$

[3, 2, 3]

$$\begin{cases} 5x_1 + 8x_2 + 7x_3 + 90 = u_1 \\ 7x_1 + 9x_2 + 6x_3 + 62 = u_2 \\ u_1 = u_2 \end{cases} \dots\dots\dots \text{E38, Q8}$$

[3, 2, 4]

$$\begin{cases} 5x = 20q + r \\ 7y = 20(q + 1) + (r + 1) \\ 9z = 20(q + 2) + (r + 2) \\ 0 \leq q = r < 18 \end{cases} \dots\dots\dots \text{E81}$$

[3, 4, 7]

$$\begin{cases} x_1 + x_2 + x_3 = 390 \\ u_1 = 5 \cdot 7 \cdot x_1/100 \\ u_2 = 2 \cdot 10 \cdot x_2/100 \\ u_3 = 4 \cdot 5 \cdot x_3/100 \\ x_i + u_i = v \ (i = 1, 2, 3) \end{cases} \dots\dots\dots \text{E46}$$

[4, 0, 4]

$$\begin{cases} x_1 : x_2 = 2 : 1 \\ y_1 + y_2 = 13/64 \\ x_1/y_1 = 3\frac{1}{2} \\ x_2/y_2 = 8 \end{cases} \dots\dots\dots \text{E48}$$

[4, 4, 7]

$$\begin{cases} (8 - 3)x_1 + x_2 + x_3 + x_4 = u_1 \\ x_1 + (10 - 3)x_2 + x_3 + x_4 = u_2 \\ x_1 + x_2 + (100 - 3)x_3 + x_4 = u_3 \\ x_1 + x_2 + x_3 + (5 - 3)x_4 = u_4 \\ u_1 = u_2 = u_3 = u_4 \end{cases} \dots\dots\dots \text{E44}$$

$$\begin{cases} 5x_1 + 2x_2 + 8x_3 + 7x_4 = u_1 \\ 3x_1 + 7x_2 + 2x_3 + x_4 = u_2 \\ 6x_1 + 4x_2 + x_3 + 2x_4 = u_3 \\ 8x_1 + x_2 + 3x_3 + x_4 = u_4 \\ u_1 = u_2 = u_3 = u_4 \end{cases} \dots\dots\dots \text{E77}$$

[8, 0, 6]

$$\begin{cases} x_1 + x_2 + x_3 + x_4 = 100 \\ y_1 + y_2 + y_3 + y_4 = 100 \\ y_1/x_1 = 3/5, y_2/x_2 = 5/7 \\ y_3/x_3 = 7/9, y_4/x_4 = 9/3 \end{cases} \dots\dots\dots \text{E78-79}$$

III.2.2. Quadratic Equations

[1, 0, 1]

$$\sqrt{x/2} + 8 \cdot (x/9) + 2 = x \dots\dots\dots \text{E61}$$

$$x/2 + 4\sqrt{x} + 6 + 3 + 1 = x \dots\dots\dots \text{E62}$$

$$\left\{ \left( \frac{x}{9} + x - 9 \right)^2 + \sqrt{\left( \frac{x}{9} + x - 9 \right)^2} \right\} \times 0 = 90 \dots\dots\dots \text{E64 in AM}$$

$$\left\{ \left( \frac{x}{9} \pm x \right)^2 + \sqrt{\left( \frac{x}{9} \pm x \right)^2} \right\} \times 0 = 90 \dots\dots\dots \text{E64 in T}$$

$$\left\{ \left( \frac{x}{9} \pm 10^7 \right)^2 + \sqrt{\left( \frac{x}{9} \pm 10^7 \right)^2} \right\} \times 0 = 90 \dots\dots\dots \text{E64 in GP}$$

$$\left[ \left\{ \left( x + \frac{x}{2} \right) \cdot 0 \right\}^2 + 2 \cdot \sqrt{\left\{ \left( x + \frac{x}{2} \right) \cdot 0 \right\}^2} \right] \div 0 = 15 \dots\dots\dots \text{E65}$$

$$(x/8)^2 + 12 = x \dots\dots\dots \text{E68}$$

$$(x/5 - 3)^2 + 1 = x \dots\dots\dots \text{E69}$$

[1, 1, 1]

$$6x^2 + 2x = u^2 \dots\dots\dots \text{E89}$$

$$(x^2 - 4)/7 = u \dots\dots\dots \text{E103.1}$$

$$(x^2 - 30)/7 = u \dots\dots\dots \text{E103.2}$$

$$(5x^2 + 3)/16 = u \dots\dots\dots \text{E105}$$

[1, 1, 2]

$$\begin{cases} x^2 + b^2 = u^2 \\ x + u = a \\ a = 32, b = 16 \end{cases} \dots\dots\dots \text{E57}$$

$$\begin{cases} x^2 + b^2 = u^2 \\ u = x + a \\ a = \frac{1}{2}, b = 2 \end{cases} \dots\dots\dots \text{E58}$$

$$\begin{cases} (x + a)^2 + b^2 = u^2 \\ x + u = a + b \\ a = 100, b = 200 \end{cases} \dots\dots\dots \text{E59}$$

$$\begin{cases} x^2 + a^2 = u^2 \\ x - u/3 = 14 \\ a = 12 \end{cases} \dots\dots\dots \text{E70}$$

[1, 2, 2]

$$3x + 1 = u^2, 5x + 1 = v^2 \dots\dots\dots \text{E100}$$

[1, 2, 3]

$$\begin{cases} x^2 + u_1^2 = c^2 \\ x^2 + u_2^2 = b^2 \\ u_1 + u_2 = a \\ a = -1 + \sqrt{18}, b = \sqrt{6} \\ c = -\sqrt{5} + \sqrt{10} \end{cases} \dots\dots\dots \text{E51}$$

$$\begin{cases} x^2 + u_1^2 = c^2 \\ x^2 + u_2^2 = b^2 \\ u_1 + u_2 = a \\ a = 14, b = 15, c = 13 \end{cases} \dots\dots\dots \text{E56}$$

$$\begin{cases} u_1 + u_2 = x \\ x : a = a : u_1 \\ x : b = b : u_2 \\ a = 15, b = 20 \end{cases} \dots\dots\dots \text{E73}$$

[1, 3, 3]

$$\begin{cases} u_1 + u_2 = u \\ a : u = x : u_2 \\ b : u = x : u_1 \\ a = 15, b = 10 \end{cases} \dots\dots\dots \text{E60}$$

[1, 3, 4]

$$\begin{cases} v^2 + u_1^2 = b^2 \\ v^2 + u_2^2 = x^2 \\ u_1 + u_2 = a \\ A = (a/2) \cdot v \\ a = \sqrt{13}, b = \sqrt{5}, A = 4 \end{cases} \dots\dots \text{E50}$$

[2, 0, 1]

- $8x^2 + 1 = y^2 \dots\dots\dots \text{E28.1}$
- $11x^2 + 1 = y^2 \dots\dots\dots \text{E28.2}$
- $67x^2 + 1 = y^2 \dots\dots\dots \text{E29.1}$
- $61x^2 + 1 = y^2 \dots\dots\dots \text{E29.2}$
- $13x^2 - 1 = y^2 \dots\dots\dots \text{E30.1}$
- $8x^2 - 1 = y^2 \dots\dots\dots \text{E30.2}$
- $6x^2 + 3 = y^2 \dots\dots\dots \text{E31.1}$
- $6x^2 + 12 = y^2 \dots\dots\dots \text{E31.2}$
- $6x^2 + 75 = y^2 \dots\dots\dots \text{E31.3}$
- $6x^2 + 300 = y^2 \dots\dots\dots \text{E31.4}$
- $32x^2 + 1 = y^2 \dots\dots\dots \text{E32}$
- $9x^2 + 52 = y^2 \dots\dots\dots \text{E33.1}$
- $4x^2 + 33 = y^2 \dots\dots\dots \text{E33.2}$
- $13x^2 - 13 = y^2 \dots\dots\dots \text{E34.1}$

$$13x^2 + 13 = y^2 \dots\dots\dots \text{E34.2}$$

$$-5x^2 + 21 = y^2 \dots\dots\dots \text{E35}$$

$$\begin{cases} A(n) = (n/2) \cdot \{2a + d(n - 1)\} \\ 3A(x) = A(y) \\ a = 3, d = 2 \end{cases} \dots\dots\dots \text{E93}$$

$$xy = 4x + 3y + 2 \dots\dots\dots \text{E106, Q12}$$

$$2xy = 10x + 14y - 58 \dots\dots\dots \text{E109}$$

$$xy + 3x + 5y = 62 \dots\dots\dots \text{E110}$$

[2, 1, 2]

$$\begin{cases} x + y + xy + x^2 + y^2 = u^2 \\ x + y + u = 23 \end{cases} \dots\dots\dots \text{E108.1, Q13}$$

$$\begin{cases} x + y + xy + x^2 + y^2 = u^2 \\ x + y + u = 53 \end{cases} \dots\dots\dots \text{E108.2, Q14}$$

[2, 2, 2]

$$\begin{cases} 7x^2 + 8y^2 = u^2 \\ 7x^2 - 8y^2 + 1 = v^2 \end{cases} \dots\dots\dots \text{E94}$$

$$\begin{cases} x^2 + xy + y^2 = u^2 \\ (x + y)u + 1 = v^2 \end{cases} \dots\dots\dots \text{E96}$$

$$\begin{cases} y^2 + x^2 + 1 = u^2 \\ y^2 - x^2 + 1 = v^2 \end{cases} \dots\dots\dots \text{E99.1}$$

$$\begin{cases} y^2 + x^2 - 1 = u^2 \\ y^2 - x^2 - 1 = v^2 \end{cases} \dots\dots\dots \text{E99.2}$$

$$\begin{cases} 2(x^2 - y^2) + 3 = u^2 \\ 3(x^2 - y^2) + 3 = v^2 \end{cases} \dots\dots\dots \text{E102}$$

[2, 5, 5]

$$\begin{cases} x = 5q_1 + 1 \\ y = 6q_2 + 2 \\ |x - y| = 3q_3 + 2 \dots\dots\dots E83 \\ x + y = 9q_4 + 5 \\ xy = 7q_5 + 6 \end{cases}$$

[3, 0, 2]

$$\begin{cases} x^2 + y^2 = z^2 \dots\dots\dots E53.1 \\ xy/2 = z \end{cases}$$

$$\begin{cases} x^2 + y^2 = z^2 \dots\dots\dots E53.2 \\ xy/2 = xyz \end{cases}$$

$$\begin{cases} x^2 + y^2 = z^2 \\ \sqrt{x-3} - 1 = z - y \dots\dots\dots E74 \end{cases}$$

[3, 0, 3]

$$\begin{cases} x^2 + y^2 = z^2 \\ x + y + z = 40 \dots\dots\dots E75 \\ xy = 120 \end{cases}$$

[4, 0, 1]

$$\sum_{i=1}^4 x_i = \sum_{i=1}^4 x_i^2 \dots\dots\dots E52.1$$

[4, 0, 3]

$$\begin{cases} y = 5x_1z/100 \\ x_2 = x_1 - y^2 \dots\dots\dots E42 \\ y = 10x_2z/100 \end{cases}$$

$$\begin{cases} y = 1x_1z/100 \\ x_2 = x_1 - y^2 \dots\dots\dots E43 \\ y = 5x_2z/100 \end{cases}$$

[4, 7, 8]

$$\begin{cases} x_i + p = u_i^2 \quad (i = 1, 2, 3, 4) \\ x_i x_{i+1} + q = u_{i+4}^2 \quad (i = 1, 2, 3) \\ \sum_{i=1}^7 u_i + a = b^2 \\ a = 11, \quad b = 13, \quad p = 2, \quad q = 18 \\ \dots\dots\dots E71-72 \end{cases}$$

III.2.3. Cubic Equations

[1, 0, 1]

$$12x + x^3 = 6x^2 + 35 \dots\dots\dots E66$$

[1, 1, 1]

$$(x^3 - 6)/5 = u \dots\dots\dots E104$$

[1, 2, 2]

$$3x + 1 = u^3, \quad 3u^2 + 1 = v^2 \dots\dots\dots E101$$

[2, 0, 1]

$$(x + y)^2 + (x + y)^3 = 2(x^3 + y^3) \dots\dots\dots E90$$

[2, 2, 2]

$$x^3 + y^3 = u^2, \quad x^2 + y^2 = v^3 \dots\dots\dots E55$$

$$x - y = u^2, \quad x^2 + y^2 = v^3 \dots\dots\dots E92$$

$$x^2 + y^3 = u^2, \quad x + y = v^2 \dots\dots\dots E95$$

[2, 3, 3]

$$\begin{cases} x + y = u^2 \\ x - y = v^2 \dots\dots\dots E54 \\ xy = w^3 \end{cases}$$

[2, 6, 6]

$$\begin{cases} x + y + 2 = r^2 \\ x - y + 2 = u^2 \\ x^2 + y^2 = v^2 \\ x^2 - y^2 + 8 = w^2 \dots\dots\dots E97 \\ (xy + y)/2 = t^3 \\ r + u + v + w + t = q^2 \end{cases}$$

$$\begin{cases} x + y + 3 = r^2 \\ x - y + 3 = u^2 \\ x^2 + y^2 - 4 = v^2 \\ x^2 - y^2 + 12 = w^2 \\ xy/2 + y = t^3 \\ r + u + v + w + t + 2 = q^2 \end{cases} \dots\dots\dots \text{E98}$$

[3, 0, 3]

$$\begin{cases} x^2 + y^2 = z^2 \\ x + y + z = 56 \dots\dots\dots \text{E76} \\ xyz = 4200 \end{cases}$$

[3, 1, 4]

$$\begin{cases} (z - 1)/2 = x \\ x/2 = y \\ xyz + xyz/7 = u \\ u = (z/2) \cdot \{2x + y(z - 1)\} \end{cases} \dots\dots\dots \text{E63}$$

[4, 0, 1]

$$\sum_{i=1}^4 x_i^2 = \sum_{i=1}^4 x_i^3 \dots\dots\dots \text{E52.2}$$

*III.2.4. Bi-quadratic Equations*

[1, 0, 1]

$$(x^2)^2 - (200x + x^2) \times 2 = 10^4 - 1 \dots\dots\dots \text{E67}$$

[1, 1, 1]

$$5(x^2)^2 - 100x^2 = u^2 \dots\dots\dots \text{E91}$$

[4, 0, 1]

$$20(x_1 + x_2 + x_3 + x_4) = x_1x_2x_3x_4 \dots\dots\dots \text{E107}$$

### III.3 Glossary of Technical Terms in the *Bījagaṇita*

I include in this glossary not only purely mathematical terms but also related words like *sat* ('correct'), *asat* ('incorrect'), *mati* ('intellect'), etc. On the other hand, I exclude ordinary numerals, ordinary expressions of fractions, word numerals (the so-called *bhūtasamkhyās*, for which see Appendix 4), and weights and measures (for which also see Appendix 4). Under each item I list notable compounds and modifiers or modified words that occur in the *Bījagaṇita*, indicating the item heading by '\*', with a hyphen (or hyphens) for a compound. abbr. = abbreviation, caus. = causative, esp. = especially, pass. = passive. Order of the Indian letters: a, ā, i, ī, u, ū, ṛ, ṝ, ḷ, e, ai, o, au, ṁ, ḥ; k, kh, g, gh, ṅ; c, ch, j, jh, ṅ; ṭ, ṭh, ḍ, ḍh, ṇ; t, th, d, dh, n; p, ph, b, bh, m; y, r, l, v; ś, ṣ, s, h.

#### a

aṁśa. Part. Numerator of a fraction.

cheda\*-viparyāsa.

akṛti-tva. The state of being a non-square number.

akṣara. Letters of the alphabet. Those beginning with ka (consonantal letters) are referred to by Bhāskara as examples of symbols for unknown numbers. See BG 68p1. Cf. nāma-aṅkita.

varṇa\*.

akhila. Not barren, soluble (problem).

agra. Tip.

mūla\*-ga.

agra. Residue.

lava\*.

liptā\*.

aṅka. Digit. Coefficient of unknown number.

kālaka\*.

bhāvita\*.

yāvattāvad\*.

yāvad\*.

varṇa\*.

vyakta\*.

aṅkita. Marked (with a letter).

nāma\*.

ajñāta. Unknown (quantity).

adhana. Negative quantity.

adhika. Greater than. Increased by.

ananta. Infinite (quantity).

\*(o) rāśiḥ.

analpa. Greater (quantity).

aniyata-ādhāra-kriyā. Operation whose ground is uncertain.

aniyata-ādhārika. (Operation) whose ground is uncertain.

aniyama. Without rule, without restriction.

anupapanna-tva. The state of not being proved or derived.

anupāta. Proportion.

aneka-pada-ānāyana. Bringing (calculating) many roots (by means of *varga-prakṛti*).

aneka-varṇa-madhyama-āharaṇa.

Elimination of the middle term of a quadratic equation in many colors (unknown numbers) or the solution

- procedure by means of it.
- aneka-varṇa-samīkaraṇa. Equation in many colors (unknown numbers) or the solution procedure for algebraic problems by means of it. The third item of *bīja-catuṣṭaya*.
- anta. End.
- antaḥkṣetraphala. The area of the inner figure.
- antar. Inside.  
kṣetra-\*-gata.
- antara. Difference.
- antara-bhāvanā. Generative method by difference. See *bhāvanā*.
- antar-bhūta-tva. The state of being inside (a figure).
- antar-vartin. Existing inside.
- antya. Last.
- anvita. Accompanied with.
- apagama. Elimination (of letters in equations).
- apa- $\sqrt{n}$ ī. To subtract.
- apavarta(na). Reduction of two or more integers by a common factor. Reducer, common factor.
- apa- $\sqrt{v}$ ṛt. Caus. to reduce, divide two or more integers by a common factor without remainder. The common factor is naturally expected to be an integer but once (in BG E30p3) Bhāskara uses this verb with *ardha* ('half') for the divisor.
- apahr̥ta. Divided.
- apās (apa- $\sqrt{as}$ ). To subtract.
- abhāva. Non-existence.  
avyakta-pakṣa-mūla-\*,  
karaṇī-gata-mūla-\*,  
kṣepa-\*,  
prajojana-\*,  
phala-viśeṣa-\*,  
mūla-\*,  
abhinna. Undivided, integer.  
abhihati. Product.  
abhīpsita. Desired, optional.  
abhīṣṭa. Desired, optional.  
abhyadhika. Increased by.  
abhyasta. Multiplied by.  
abhyāsa. Multiplication. Product.  
vajra-\*,  
arūpa(ka). Without invariable number.  
ardha. Half.  
ardhita. Halved.  
alpa(ka). Smaller.  
avataraṇa. Introduction (of operation).  
kriyā-\*,  
avatāra. Introduction (of rule).  
sūtra-\*,  
avarga-tva. The state of being a non-square number.  
avalambaka. Perpendicular.  
avaśiṣṭa. Remaining.  
\*-kṣetra.  
avaśeṣa. Remainder.  
kalā-\*,  
vikalā-\*,  
avāpti. Quotient.  
avikṛta. Unchanged (quantity).  
avyakta. Invisible, unknown (quantity). Cf. *vyakta*.  
\*-apavartana,  
\*-kalpanā,  
\*-kṛti,  
\*-māna,  
\*-miti,  
\*-mūla,  
\*-yukti,  
\*-rāśi,  
\*-rāśi-śeṣa,  
\*-varga,

\*-varga-ādi-samīkaraṇa,  
 \*-varga-rāśi,  
 \*-śeṣa,  
 ṛṇa\*-ṣaṭka,  
 dhana\*-yugma,  
 śeṣa-\*,  
 sa-\*.  
 avyakta-gaṇita. Mathematics with unknown numbers. Cf. vyakta-gaṇita.  
 avyakta-pakṣa. The side of unknown numbers of an equation, which exclusively consists of unknown numbers. Cf. vyakta-pakṣa.  
 \*-mūla-abhāva.  
 aṣṭa-gata. Raised to the eighth power.  
 asakṛt. Repeatedly.  
 asakṛt-kriyā. Repeated calculation.  
 asat. Incorrect.  
 asama. Different.  
 asama-jāti. Of different category.  
 asamāna. Different.  
 asra. Side of a geometric figure.  
 āyata-catur\*-kṣetra,  
 catur-\*,  
 try-\*,  
 try\*-kṣetra,  
 viṣama-try-\*,  
 sama-catur\*-kṣetra.  
 asva. Negative quantity.  
 ahar-gaṇa. Number of the days accumulated from an epoch.

### ā

āgata. Obtained.  
 yathā-\*.  
 ā-√gam. To arrive at, obtain.  
 āḍhya. Increased by.  
 ādi(ka). The first of a series of things or numbers.

ādyā. First. The first of a series of things or numbers.  
 \*-akṣara,  
 \*-udāharaṇa,  
 \*-karaṇī,  
 \*-khaṇḍa,  
 \*-dhana,  
 \*-pakṣa,  
 \*-pada-sāmya,  
 \*-bīja-kriyā,  
 \*-miti,  
 \*-mūla,  
 \*-varṇa,  
 \*-varṇa-unmiti,  
 \*-varṇa-śeṣa,  
 \*-vitta.  
 ādhāra. Ground (of operation).  
 aniyata-\*,  
 aniyata\*-kriyā,  
 niyata\*-kriyā-vat,  
 nir-\*.  
 -ādhārika. Having such and such ground.  
 aniyata-\*.  
 ānantya. Infinity.  
 ānāyana. Bringing (answer), computing, solving.  
 aneka-pada-\*,  
 pada-\*,  
 mūla-\*,  
 rūpa-kṣepa-pada-\*.  
 ā-√nī. To bring, compute, solve.  
 ānīta. Brought, computed, solved.  
 āpta. Reached, obtained (by computation, esp. by division).  
 āpti. Quotient.  
 ābādhā. See āvādhā.  
 āyata-caturasra-kṣetra. Elongated quadrilateral figure, oblong.  
 ā-√yā. To reach, attain (by computation).



$\bar{a}$ - $\sqrt{\text{rabh}}$ . To begin (calculation).  
 ālāpa. Statement (of a condition of a mathematical problem).  
     uddeśaka-\*,  
     pūrva-\*.  
 ālāpita. Stated, given (in mathematical problem).  
 āvādhā. Segment (lit. oppression) of the base of a trilateral from the perpendicular to each end of the base, or of a quadrilateral from a perpendicular to the near end of the base.  
     \*-pramāṇa,  
     koṭy-āsrita-\*,  
     bṛhad-vaṃśa-āsrita-\*,  
     bhuja-āsrita-\*,  
     laghu-vaṃśa-āsrita-\*.  
 āśrita. Depending. Cf. āvādhā.  
 āsanna. Near, approximate.  
     yathā-\*.  
 āsanna-mūla. Approximate root.  
     \*-karaṇa.  
 āhata. Multiplied.  
 āhati. Product.  
     varṇa-aṅka-\*.  
 āharaṇa. Taking away, eliminating (the middle term of a quadratic equation).  
     aneka-varṇa-madhyama-\*,  
     eka-varṇa-madhyama-\*.

## i

$\sqrt{i}$ . To go to (a particular state such as the state of being a negative number).  
 icchā. Requisite, esp. the third term of trairāśika. Cf. pramāṇa, pramāṇa-phala.  
 iyat-tā. The state of being so much, limit.

\*-vaśāt.

iṣṭa. Desired, optionally chosen (quantity or unknown number).  
     \*-varṇa,  
     \*-vaśāt,  
     \*-siddhi.

## ī

īpsita. Desired, optionally chosen (quantity).  
     yathā-\*.

## u

ucchraya/ucchrāya. Height.  
     vṛkṣa-\*.  
 utara. Common difference (of an arithmetical progression).  
 -uttha. Produced from, originating from.  
     rūpa-kṣepa-pada-\*.  
 utthā (ud- $\sqrt{\text{sthā}}$ ). Caus. to raise. See the next item.  
 utthāpana. Raising. 'Raising A by B' means 'substituting B for A'. For a definition see BG 68p4.  
     \*-prakāra,  
     vilomaka-\*,  
     śūnya-eka-dvy-ādy-\*.  
 utthāpita. Raised.  
 utthāpya. To be raised.  
 utpad (ud- $\sqrt{\text{pad}}$ ). To be produced.  
 utpanna. Produced from, originating from.  
     ṛṇa-\*.  
 udāharaṇa. Illustration, example for a mathematical rule. Functions also as a kind of proof of that rule.  
     \*-anta,  
     ādya-\*.

ud-ā-√hr̥. To illustrate (a mathematical rule with examples).  
 udāhr̥ta. Illustrated.  
 udāhr̥ti. Illustration, example.  
 uddiṣṭa. Mentioned, questioned.  
 khila-\*.  
 uddeśaka. Questioner. Illustrative example.  
 \*-ālāpa,  
 sa-sūtra-\*.  
 uddhṛ (ud-√hr̥). To divide.  
 uddhṛta. Divided.  
 udbhava. Produced from, originating from.  
 dhana-bhājya-\*.  
 unmāna = unmiti.  
 kālaka-\*,  
 nīlaka-\*,  
 yāvattāvad-\*.  
 unmiti. Measure, estimation, evaluation of a particular unknown number, which contains other unknown numbers.  
 antya-\*,  
 kālaka-\*,  
 nīlaka-\*,  
 pītaka-\*,  
 bhāvita-\*,  
 yāvattāvad-\*,  
 varṇa-\*.  
 upadeśa. Instruction.  
 upapatti. Proof. According to Bhāskara (BG 93p3–p4), there are two kinds of proof, kṣetra-gatā and rāśi-gatā.  
 \*-yuta,  
 \*-prakāra,  
 kṣetra-gatā \*(ḥ),  
 bhāvita-\*,  
 rāśi-gata-\*.  
 upa-√pad. To be fit, right, proved.

upapanna. Fit, right, proved.  
 upari. Upper.  
 \*-tana-pakṣa.  
 upalakṣaṇa. Mark, sign.  
 upasaṃhāra. Contracting (calculations).  
 kriyā-\*.  
 upāntima. Penultimate.  
 upāya. Mode, way, strategy.  
 kalpanā-\*.  
 upeta. Accompanied by, increased by.

## ū

ūna. Less by.  
 ūnita. Less by.  
 ūrdhva. Upper.  
 \*-khaṇḍa,  
 \*-pakṣa.

## ṛ

ṛṇa. Debt. Negative quantity.  
 \*-avyakta,  
 \*-ātmika,  
 \*-utpanna,  
 \*-karaṇī,  
 \*-kṣepa,  
 \*-triṣaṣṭi,  
 \*-tva,  
 \*-bhājaka,  
 \*-bhājya,  
 \*-rūpa,  
 dhana-\*-tā-vyatyaya,  
 dhana-\*-tva-vyatyāsa,  
 dhana-\*-vyatyāsa,  
 vyasta-dhana-\*-ga,  
 sva-sva-\*-ga.  
 ṛṇa-ga. In the state of being a negative quantity.  
 \*-rūpa.  
 ṛṇa-gata = ṛṇa-ga.

## e

eka-dvi-tri-gata. Raised to the first, the second and the third powers.

eka-dvi-tri-catur-gata. Raised to the first, the second, the third, and the fourth powers.

eka-varṇa-madhyama-āharaṇa. Elimination of the middle term of a quadratic equation in one color (unknown number) or the solution procedure by means of it.

eka-varṇa-samīkaraṇa. Equation in one color (unknown number) or the solution procedure for algebraic problems by means of it. The first item of *bīja-catuṣṭaya*.

## ai

aikya. Sum.

## k

ka. The first consonant of the alphabet, mentioned by Bhāskara as an example of symbols for unknown numbers. See BG 68p1. Cf. *akṣara*, *nāma-aṅkita*.

ka. Abbr. of *kaniṣṭha*.

ka. Abbr. of *karaṇī*.

kati. How much, how many.

kaniṣṭha. Abbr. of *kaniṣṭha-pada* and *kaniṣṭha-mūla*.

kaniṣṭha-pada = *kaniṣṭha-mūla*.

kaniṣṭha-mūla. 'The least root,' the smaller of the two roots of *varga-prakṛti*.

kapilaka. Tawny. One of the words for unknown numbers; its initial

letter, *ka*, is used as a symbol. See BG 68p1.

karaṇa. Making (arithmetical calculation, modulo operation, equation, etc.). Computation, esp. a series of mathematical operations made for a specific type of problems.

*kuṭṭaka*\*,

*taṣṭi*\*,

*yukta-ūnī*\*,

*sama-cchedī*\*,

*samī*\*,

*sāmya*\*.

karaṇa-sūtra. Computational rule designed for a specific type of problems.

karaṇī. Making (a square). Number whose square root is to be extracted.

\*-*khaṇḍa*,

\*-*tva-hetu*,

*ṛṇa*\*,

*dhana*\*,

*mūla*\*.

karaṇī-gata. In the state of being a *karaṇī*.

\*-*mūla*.

karṇa. 'Ear,' indicating the hypotenuse of a right-angled triangle and the diagonal of a rectangle.

karman. Computation.

kalpanā (rarely *kalpana*). Assuming, setting (a symbol or symbols and/or a number for an unknown number in particular).

\*-*upāya*,

\*-*bheda*,

\*-*vaśāt*,

*avyakta*\*,

*evaṃ-vidha*\*.

- bhūmi-\*,  
 varṇa-\*,  
 yāvattāvat-\*.  
 kalpita. Assumed.  
 \*-pada,  
 \*-rāśi.  
 kalpya. To be assumed.  
 kā. Abbr. of kālaka. Symbol for the second unknown number.  
 kāgha. Abbr. of kālaka-ghana.  
 kānībhā. Abbr. of kālaka-nīlaka-bhāvita.  
 kāra. Letter (for expressing unknown number).  
 yā-\*.  
 kārya. To be made in general, to be calculated in particular.  
 kālaka. Black. Word for the second unknown number; its initial letter, kā, is used as a symbol for it. See BG 7, 68p1.  
 \*-aṅka,  
 \*-unmāna,  
 \*-unmiti,  
 \*-ghana,  
 \*-nīlaka-māna,  
 \*-pakṣa,  
 \*-pakṣa-mūla,  
 \*-māna,  
 \*-varga,  
 \*-varṇa-māna,  
 yāvattāvat-\*-māna,  
 yāvattāvat-\*-varṇa.  
 kāva. Abbr. of kālaka-varga.  
 kāvayābhā. Abbr. of kālaka-varga-yāvattāvad-bhāvita.  
 kim. What (quantity).  
 kuṭṭaka (rarely kuṭṭa). Pulverizer: method for solving the linear indeterminate equation  $y = \frac{ax+c}{b}$  where the coefficients,  $a$  and  $b$ , are ‘pulverized’ successively.  
 \*-adhyāya,  
 \*-artha,  
 \*-karaṇa,  
 \*-jña,  
 \*-vidhi,  
 \*-vedin,  
 ghana-\*,  
 varga-\*,  
 saṃśliṣṭa-\*,  
 sthira-\*,  
 sphuṭa-\*.  
 $\sqrt{\text{kr}}$ . To do, make in general, to calculate in particular.  
 tri-guṇī-\*,  
 ṣaḍ-guṇī-\*,  
 sama-cchedī-\*,  
 samī-\*.  
 kṛta. Made in general, calculated in particular.  
 kṛtī-\*,  
 dalī-\*,  
 sama-cchedī-\*,  
 samī-\*.  
 kṛta-sama-ccheda. (Fractions) reduced to the same denominator.  
 kṛti. Square.  
 \*(ī)-kṛta,  
 \*(ī)-bhūta,  
 \*-yuti-viyuti,  
 avyakta-\*,  
 varga-\*,  
 varṇa-\*.  
 kṛti-prakṛti = varga-prakṛti.  
 kṛti-mūla = varga-mūla.  
 $\sqrt{\text{klp}}$ . To assume (the positive or negative sign for a number, a symbol or symbols and/or a number for an unknown number, etc).

- koṭi. 'Edge,' indicating one of the two sides that contain the right corner of a right-angled triangle, the other being bhuja. For a definition see L 135.  
 \*-āśrita-āvādhā,  
 \*-kaṛṇa-antara,  
 \*-bhuja-antara,  
 doḥ\*-antara-varga,  
 bhuja\*-māna,  
 bhuja\*-vadha.
- koṇa. Corner.  
 \*-stha,  
 bahiḥ\*-stha.
- koṣṭhaka. Box, cell, unit square.
- krama. Step, order, procedure.  
 \*-śas,  
 yathā\*.
- kraya. Buying rate (of commodity per price). Cf. vikraya.
- kriyā. Action in general, computation in particular.  
 \*-avataṛaṇa-artha,  
 \*-upasaṃhāra,  
 \*-lāghava-artha,  
 \*-saṃkoca,  
 \*-hetu,  
 aniyata-ādhāra\*  
 asakṛt\*  
 niyata-ādhāra\*  
 bīja\*  
 sama\*.
- kṣaya. Loss. Negative quantity.  
 \*-avyakta-yugma,  
 \*-ātmika,  
 \*-rūpa.
- kṣaya-ga. In the state of being a negative quantity.  
 \*-prakṛti.
- √kṣip. To add.
- kṣipta. Added.
- kṣuṇṇa. Multiplied.
- kṣe. Abbr. of kṣepa.
- kṣetra. Field, geometric (plane) figure.  
 \*-antar,  
 \*-antar-gata,  
 \*-phala,  
 \*-bhuja,  
 \*-mūla-antar-bhūta,  
 antaḥ\*  
 antaḥ\*-phala,  
 avasiṣṭa\*  
 tryasra\*  
 bahiḥ\*  
 bṛhat\*  
 bhāvita\*  
 laghu\*.
- kṣetra-gata-upapatti. Proof based on figures. See BG 93p3.
- kṣetra-darśana. Showing figures for illustration.
- kṣetra-vyavahāra. Procedure for plane figures, which is one of the eight kinds of 'procedures' (vyavahāra) treated in the L.
- kṣepa(ka). Additive (number, term).  
 \*-abhāva,  
 \*-takṣaṇa-lābha,  
 ṛṇa\*  
 catuḥ\*-mūla,  
 trayodaśa\*-mūla,  
 dvi\*-mūla,  
 dhana\*  
 pañca\*-pada,  
 prakṛti-sama\*  
 rāśi\*  
 rūpa\*-artha-bhāvanā,  
 rūpa\*-pada,  
 rūpa\*-bhāvanā,  
 rūpa\*-mūla,  
 vadha\*  
 sa\*.

sama-\*

kṣepya. To be added.

### kh

kha. Zero.

kha-guṇa. (A quantity) having zero as its multiplier. Cf. kha-hara/hāra.

khaṇḍa(ka). Part.

\*-saṃkhyā,  
karaṇī-\*,  
guṇaka-\*

khaṇḍa-guṇanā. Multiplication by parts. See L 14.

\*-vidhi.

kha-hara/hāra. (A quantity) having zero as its divisor. Cf. kha-guṇa.

khila. Barren, impossible, insoluble.

\*-tva.

khila-uddiṣṭa. Questioned in vain, insoluble problem.

### g

-ga. In, in the state of.

ṛṇa-*rūpatas*,  
kṣaya-*ekādaśa*,  
kṣaya-*prakṛti*,  
kṣaya-*śaṣṭi*,  
dhana-*ṛṇa*\*,  
vyasta-dhana-*ṛṇa*\*,  
sva-sva-*ṛṇa*.\*

gaccha. Number of terms of a series.

√gaṇ. To compute.

gaṇa. A flock, group.

bha-\*,  
mārgaṇa-\*,  
śara-\*

gaṇaka. Calculator, mathematician.

\*-ānanda-kāraka,

gaṇita. Computation, mathematics.

\*-jña,  
avyakta-\*,  
graha-\*,  
pāṭī-\*,  
bīja-\*,  
bīja-*adhyāya*,  
bīja-*āhvayatā*,  
bīja-*jña*,  
bīja-*saṃjña*,  
vyakta-\*,  
śreḍhī-\*,  
sakala-*sāra*.

-gata. In, in the state of. Depending on. Raised to (the *n*-th power of ten).

kṣetra-*antar*\*,  
aṣṭa-\*,  
ṛṇa-\*,  
ekadvitri-\*,  
ekadvitricatur-\*,  
karaṇī-\*,  
karaṇī-*mūla*,  
kṣetra-*(ā) upapattiḥ*,  
catur-\*,  
triṣaṇṇava-\*,  
dvi-\*,  
dhana-\*,  
bhājya-\*,  
rāśi-*upapatti*,  
varga-*ādi*\*,  
varga-\*,  
ṣaḍ-\*

gati. Journey, distance.

sama-\*

gama. Removal, elimination.

cheda-\*,  
sama-varga-\*,  
samīkṛta-cheda-\*

gāmbhīrya. Depth.

jala-\*

$\sqrt{\text{guṇ}}$ . To multiply.  
 guṇa. Multiplier. Multiplication.  
     \*-aikya,  
     \*-kāra,  
     \*-mūla,  
     kha-\*,  
     yāvattāvad-varga-\*.  
 guṇaka. Multiplier.  
     \*-ja-phala.  
 guṇana(or -ā). Multiplication.  
     \*-phala,  
     \*-vidhi,  
     khaṇḍa-\*.  
 guṇita. Multiplied.  
 guṇī- $\sqrt{\text{kṛ}}$ . To multiply.  
     tri-\*,  
     ṣaḍ-\*.  
 guṇya. To be multiplied.  
 grhīta. Obtained (in most cases the subject is ‘the square root’).  
 gola. Sphere. Spherical astronomy.  
 gola-adhyāya. Study on the Spherical Astronomy, the name of the fourth book of Bhāskara’s masterpiece, *Siddhānta-śiromaṇi*.  
 $\sqrt{\text{grah}}$ . To obtain (the square root).  
 graha. Planet.  
 graha-gaṇita. Computation on planets, the theme treated in the *Graha-gaṇita-adhyāya*, the third book of Bhāskara’s masterpiece, *Siddhānta-śiromaṇi*.  
 grāhya. To be obtained (in most cases the subject is ‘the square root’).

### gh

$\sqrt{\text{ghaṭ}}$ . To be accomplished, fulfilled, realized (the subject is ālāpa).

ghana. Cube.  
     \*-ātmaka,  
     \*-aikya,  
     \*-yoga,  
     kālaka-\*,  
     yāvattāvad-\*,  
     yoga-\*,  
     varga-\*.  
 ghana-kuṭṭaka. Cube pulverizer: method for solving the equation  $y = \frac{ax^3+c}{b}$ .  
 ghana-pada = ghana-mūla.  
 ghana-mūla. Cube root.  
 ghana-varga. Square of cube, the sixth power.  
 ghāta. Product.  
     yoga-antara-\*,  
     rāśi-\*.  
 -ghna. Multiplied by.

### c

cakra-vāla. Cyclic method (used in varga-prakṛti).  
 catuḥ-kṣepa-pada/mūla. Root for the additive four of varga-prakṛti.  
 catur-asra-kṣetra. Quadrilateral figure.  
     āyata-\*,  
     sama-\*.  
 catur-gata. Raised to the fourth power.  
 catur-dvi-kṣepa-mūla. Root for the additives, four and two, of varga-prakṛti.  
 catur-bhuja. Quadrilateral.  
 caya. Common difference (of an arithmetical progression).  
 citraka. Variegated color. One of the words for unknown numbers; its initial letter, ci, is used as a symbol. See BG 68p1.  
 ced. If.  
 cyuta. Subtracted.

**ch**

- chid. Divisor, denominator of a fraction.
- chinna. Divided.
- cheda. Divisor, denominator of a fraction.  
\*-aṃśa-viparyāsa,  
kṛta-sama-\*,  
sama-\*,  
sama-\*(ī)-karaṇa,  
sama-\*(ī)-kṛtya.
- cheda-gama. Elimination of the denominators.  
samīkṛta-\*

**j**

- ja. Produced from, originating from.  
ṛṇa-bhājya-\*,  
guṇaka-\*,  
yoga-\*,  
viyoga-\*.
- √jan. To be born, produced (by calculations).
- jāta. Produced (by calculations).
- jāti(ka). Category.  
asama-\*,  
dramma-\*,  
vibhinna-\*,  
samāna-\*.
- jātīya. Belonging to a particular category.  
kṣepa-\*.
- jñā. Knowing about, well-versed in.  
kuṭṭaka-\*,  
gaṇita-\*,  
bīja-\*,  
bīja-gaṇita-\*,  
bhāvita-\*.
- √jñā. To know (the answer to a mathematical problem), solve.

- jñāta. Known (quantity).
- jñātavya. To be known (quantity).
- jñāna. Knowledge, knowing (quantity).  
\*-prakāra,  
karaṇa-\*.
- jñeya. To be known (quantity).
- jye. Abbr. of jyeṣṭha.
- jyeṣṭha. Abbr. of jyeṣṭha-pada and jyeṣṭha-mūla.  
\*-kaniṣṭha-mūla,  
kaniṣṭha-vaśāt.
- jyeṣṭha-pada = jyeṣṭha-mūla.
- jyeṣṭha-mūla. 'The greatest root,' the greater of the two roots of varga-prakṛti.  
kaniṣṭha-\*

**t**

- takṣaṇa. Paring, abrading, modulo operation, i.e., division for obtaining the remainder. Divisor of that division.  
kṣepa-*lābha*.
- taṣṭa. Pared, abraded, divided for obtaining the remainder.  
hara/hāra-\*
- taṣṭi. Paring, abrading, modulo operation, i.e., division for obtaining the remainder.  
\*-karaṇa.
- tulya. Equal.  
\*-tva,  
\*-dhana,  
\*-maulya,  
\*-rūpa,  
\*-vitta,  
\*-śuddhi.
- tulya-bhāvanā. Generative method with the same (sets of roots), a kind of samāsa-bhāvanā.



√tyaj. To throw away in general, to subtract in particular.

tri-bhuja. Trilateral.

tri-ṣaṅ-ṇava-gata. Raised to the third, the sixth and the ninth powers.

trairāśika. Three quantity operation, rule of three. The three terms are called pramāṇa, pramāṇa-phala and icchā, and the fourth term to be obtained is called icchā-phala.

\*-mātra.

try-asra. Trilateral.

\*-kṣetra,

viṣama-\*

### d

-da. Giving (a number, square root).

daśa-\*,

mūla-\*

darśana. Seeing, showing.

kṣetra-\*,

pada-ānāyana-\*

dala. Half.

\*(ī)-kṛta.

√dā. To give in general, to give square root in particular.

duṣṭa. Corrupted (problem).

dūṣaṇa. Objection, refutation.

ḍḍha. Firm, relatively prime.

\*-bhājaka-bhājya,

\*-bhājya-hāra,

\*-saṃjñaka.

√ḍṣ. To see. Pass. to be seen. Caus. to show.

ḍṣṭa. Seen, and therefore 'known' (quantity).

deya. To be given in general, to be added in particular.

dos = bhuja

\*-koṭy-antara-varga.

dvi-kṣepa-mūla. Root for the additive two of varga-prakṛti.

dvi-gata. Raised to the second (square) power.

dvi-tri. Thirty-two (= dvātriṃśat).

### dh

dhana. Property. Positive quantity.

\*-avyakta-yugma,

\*-ātmaka,

\*-ātmika,

\*-ṛṇa-tā-vyatyaya,

\*-ṛṇa-tva-vyatyāsa,

\*-ṛṇa-vyatyāsa,

\*-karaṇī,

\*-kṣepa,

\*-gata,

\*-tva,

\*-bhājya,

\*-bhājya-udbhava,

\*-bhājya-vidhi,

\*-rūpa,

\*-labdhi,

tulya-\*,

mūla-\*,

vyasta-\*ṛṇa-ga,

sama-\*,

sarva-\*

dhātrī = bhū.

dhī. Intellect. Probably used by Bhāskara synonymously with budhi and mati but, unlike those words, always in compounds.

\*-mat,

manda-\*,

su-\*

dhūmraka. Smoke-colored, grey. One of the words for unknown numbers; its initial letter, dhū, is used as a symbol. See BG 68p1.

## n

nāma-aṅkita. Marked by name (modifying unknown numbers). The initial letters of the names of the things whose quantities are to be known may be used as symbols for them. See BG E44p.

nāśa. Disappearance, elimination.

niḥśeṣa. Having no remainder (when divided).

ni-√kṣip. To add.

nikhila. Whole, entire.

nighna. Multiplied.

niyata-ādhāra-kriyā. Operation whose ground is certain.

niyama. Law, rule.

niyojanīya. To be employed (the subject is varga-prakṛti).

niragra(ka). Without remainder.

nirasana. Dropping (letters for unknown numbers). A word essential for Bhāskara's definition of utthāpana. See BG 68p4.

nirādhāra. Without ground.

nir-√vah. To be finished, accomplished (the subject is computation).

nirvaha. Accomplishment (of computation).

ni-√viś. Caus. to put, place (numbers on calculating board).

niveśya. (Numbers) to be put, placed (on calculating board).

nihata. Multiplied by.

nihati. Product.

rāśi-\*

ni-√han. To multiply.

nī. Abbr. of nīlaka. Symbol for the third unknown number.

nī. Abbr. of nīla or indra-nīla (sapphire).

nīpībhā. Abbr. of nīlaka-pītaka-bhāvita.

nīlaka. Blue. Word for the third unknown number; its initial letter, nī, is used as a symbol for it. See BG 7, 68p1.

\*-unmāna,

\*-unmiti,

\*-pakṣa,

\*-māna,

\*-varga,

\*-varga-ghana,

\*-varga-varga,

kālaka-\*-māna.

nīva. Abbr. of nīlaka-varga.

nīvakābhā. Abbr. of nīlaka-varga-kāla-ka-bhāvita.

nīvagha. Abbr. of nīlaka-varga-ghana.

nīvava. Abbr. of nīlaka-varga-varga.

nyas (ni-√as). To put down, set down (numbers or figures on the calculating board).

nyasta. Put, set (on the calculating board).

nyāsa. Setting down. Tabular presentation of the numerical data.

nyūna. Smaller.

## p

pakṣa. Wing, one of a pair of things such as the sides of an equation, a multiplicand and a multiplier, etc. Option.

\*-antara,

\*-śeṣa,

adhika-\*,

avyakta-\*,

avyakta-\*-mūla-abhāva,

ādy-\*-pada-sāmya,

- ādya-\*-mūla,  
 uparitana-\*,  
 ūrdhva-\*,  
 kālaka-\*-mūla,  
 dvitīya-\*,  
 dvitīya-\*-pada,  
 nīlaka-\*-mūla,  
 para-\*,  
 pūrva-\*-mūla,  
 prathama-\*,  
 prathama-\*-pada/mūla,  
 prāk-\*-mūla,  
 vyakta-\*,  
 vyakta-\*-mūla-rūpa,  
 vyakta-\*-rūpa.
- pañca-kṣepa-pada. Root for the additive five of varga-prakṛti.
- pada. Root (square and cube)
- \*-ānayana,  
 ādya-pakṣa-\*-sāmya,  
 ṛṇa-kṣepa-\*,  
 kaniṣṭha-\*,  
 kalpita-\*,  
 ghana-\*,  
 jyeṣṭha-\*,  
 dvitīya-pakṣa-\*,  
 pañca-kṣepa-\*,  
 pūrva-\*-kṣepa,  
 prathama-pakṣa-\*,  
 yoga-\*,  
 rūpa-\*,  
 rūpa-kṣepa-\*,  
 rūpa-kṣepa-\*-uttha,  
 rūpa-śuddhi-\*,  
 hrasva-jyeṣṭha-\*,  
 hrasva-\*.
- pada-prada. Giving the square root, a square number.
- paraspara-bhajana. Mutual division (the so-called Euclidean algorithm) of the dividend and the
- divisor in kuṭṭaka.
- parikarman. Fundamental operations, six in the BG and eight in the L.
- pari-√kḷp. To assume.
- paribhāṣā. Meta-rule.
- paribhāṣita. Stated as a meta-rule.
- pari-√vṛt. Caus. to rotate (geometric figure).
- parimāṇa. Value (of unknown number).
- pariśiṣṭa. Remainder.
- pāṭalaka. Pink. One of the words for unknown numbers; its initial letter, pā, is used as a symbol. See BG 68p1.
- pāṭī. Procedure, algorithm.
- pāṭī-gaṇita. Mathematics by algorithms.
- piṅgalaka. Brown. One of the words for unknown numbers; its initial letter, pi, is used as a symbol. See BG 68p1.
- pī. Abbr. of pītaka. Symbol for the fourth unknown number.
- pītaka (or pīta). Yellow. Word for the fourth unknown number; its initial letter, pī, is used as a symbol for it. See BG 7, 68p1.
- \*-unmiti,  
 \*-māna,  
 \*-varga.
- pīva. Abbr. of pītaka-varga.
- pṛcchaka. Questioner.
- pṛthak-sthiti. Separate standing (of numbers or of unknown numbers).
- pṛṣṭa. Questioned.
- pra. Abbr. of prakṛti.
- prakalpita. Assumed.
- prakalpya. To be assumed.

prakāra. Manner, way, method.  
 ukta-\*,  
 jñāna-\*,  
 vilomaka-utthāpana-\*,  
 sa-upapatti-\*.  
 prakṛti. Nature, natural form. Coefficient  $p$  of the indeterminate equation,  $px^2 + t = y^2$ . Cf. varga-prakṛti.  
 \*-mūla,  
 \*-varṇa,  
 \*-varṇa-māna/miti,  
 \*-sama-kṣepa,  
 kṛti-\*,  
 kṣaya-ga-\*,  
 varga-\*.  
 pra-√kḷp. To assume.  
 pra-√kṣip. To add.  
 prakṣipta. Added.  
 prakṣepa. Additive.  
 pracaya. Common difference (of an arithmetical progression).  
 pracyuta. Subtracted.  
 pra-√jan. To be produced, to become.  
 pratīti. Conviction, apprehension (about negative quantity).  
 prathama-bīja. First seed, i.e., eka-varṇa-samīkaraṇa.  
 \*-kriyā,  
 -prada. Giving (square root).  
 pada-\*,  
 mūla-\*,  
 varga-mūla-\*.  
 prapañca. Manifestation, application (of mathematical rules).  
 pramāṇa. Measure. Standard, esp. the first term of trairāśika. Cf. icchā, pramāṇa-phala, phala.  
 ali-\*,  
 ali-kula-\*,  
 āvāddhā-\*,

nala-\*,  
 phala-\*,  
 yūtha-\*,  
 labdhi-\*.  
 pramāṇa-phala. Fruit of the standard, the second term of trairāśika. Cf. icchā, pramāṇa.  
 -pramita. Of such and such measure.  
 pra-√yam. To give (exact parts when divided, i.e., to be divisible).  
 pra-√vṛt. To progress (the subject is computation).  
 praśna. Problem.  
 praṣṭ. Questioner.  
 pra-√sādh. Caus. to establish, obtain.  
 prasādhya. To be accomplished, obtained.  
 pra-√sr. To advance (the subject is computation). Caus. to stretch (threads).  
 projjh (pra-√ujjh). To subtract.

### ph

phala. Fruit, result, esp. the second (pramāṇa-phala) and the fourth terms (icchā-phala) of trairāśika. Area. Sum of a series.  
 \*-aikya,  
 \*-pramāṇa,  
 \*-viśeṣa-abhāva,  
 kṣetra-\*,  
 guṇaka-ja-\*,  
 guṇana-\*,  
 pramāṇa-\*,  
 śreḍhī-\*.  
**b**

bahiḥ-koṇa-stha. Lying outside the corner.  
 bahiḥ-kṣetra. External figure.

- bahu. Many.  
 \*-tva,  
 \*-dhā.
- bāhu. 'Arm,' indicating a side of a trilateral. Usually, like bhuja, this word also means a side of any polygon but the two figures of the BG where this word is used are trilaterals.
- bindu. Dot (used as a sign of negative quantity). See BG E1p.
- bīja. 'Seed,' meaning a method for solving algebraic problems by means of equations. There are four 'seeds.' See bīja-catuṣṭaya.  
 \*-upayogin,  
 \*-jñā,  
 \*-vid,  
 \*-vit-tama,  
 padmanābha-\*,  
 pūrva-\*,  
 prathama-\*,  
 brahma-āhvaya-śrīdhara-padmanābha-\*
- bīja-kriyā. Operations with the four seeds or with one of them. See bīja-catuṣṭaya.
- bīja-gaṇita. Mathematics by seeds, that is, algebra. Also means the mathematics as a seed which generates the rules of pāṭī-gaṇita. See BG 2.  
 \*-adhyāya,  
 \*-āhvaya-tā,  
 \*-jñā,  
 \*-saṃjñā.
- bīja-catuṣṭaya. Quartet of seeds, that is, eka-varṇa-samīkaraṇa, madhyama-āharaṇa, aneka-varṇa-samīkaraṇa, and bhāvita.

See BG 58p1.

- buddhi = mati. Intellect, regarded by Bhāskara as the most essential element of the bīja-gaṇita. See BG E43p2, 61p2, E88p2, 73p3, Q15p0. Cf. dhī.  
 \*-mat,  
 ātma-\*,  
 su-\*,  
 stoka-\*,  
 sva-\*
- bṛhat. Large.  
 \*-kṣetra.

## bh

- bhakta. Divided.
- bhaṅga. Resolution (of bhāvita).  
 bhāvita-\*,  
 $\sqrt{\text{bhaj}}$ . To divide.
- bhajana. Division.  
 paraspara-\*
- bhajita. Divided.
- bhā. Abbr. of bhājya.
- bhā. Abbr. of bhāvita. See yākābhā, yānībhā, yāvākābhā, kānībhā, kāvayābhā, nīpībhā, nīvakābhā.
- bhāga. Part. Division.  
 \*-labdha,  
 \*-śeṣa,  
 aṣṭa-\*,  
 eka-\*,  
 navama-\*,  
 māna-\*,  
 sapta-\*
- bhāga-āhāra/-hāra. Division.
- bhājaka. Divisor.  
 \*-varṇa-unmiti,  
 \*-varṇa-māna,  
 ṛṇa-\*,  
 dṛdha-\*-bhājya.

bhājita. Divided.

bhājya. To be divided, dividend.

\*-gata,  
 \*-rāśi,  
 \*-varṇa,  
 \*-varṇa-māna,  
 \*-stha,  
 ṛṇa-\*,  
 dṛḍha-\*-hāra,  
 dhana-\*

bhāvanā. Generative method of varṅa-prakṛti, which is a particular algorithm for obtaining a new pair of roots when two pairs of roots are known. See BG 40–43. Cf. antara-bhāvanā, samāsa-bhāvanā, tulya-bhāvanā.

\*-artha,  
 \*-tas,  
 \*-vyatireka,  
 tulya-\*,  
 tulya-\*-artha,  
 rūpa-kṣepa-artha-\*,  
 rūpa-kṣepa-\*,  
 samāsa-antara-\*

bhāvita. Product of different unknown numbers or the solution procedure for algebraic problems by means of equations involving it. The fourth item of bīja-catuṣṭaya.

\*-aṅka,  
 \*-unmiti,  
 \*-upapatti,  
 \*-jñā,  
 sa-\*

bhāvita-kṣetra. A rectangle whose length and width are measured by two unknown numbers. See BG 93p3.

bhāvita-bhaṅga. Resolution of bhāvita,

bhinna. Fraction.

bhuja. ‘Arm,’ indicating a side of a geometric figure in general and one of the two sides that contain the right corner of a right-angled triangle in particular, the other being koṭi. For a definition of bhuja and koṭi see L 135.

\*-āsrita-āvādhā,  
 \*-koṭi-māna,  
 \*-koṭi-vadha,  
 \*-māna,  
 koṭi-\*-antara,  
 kṣetra-\*,  
 catur-\*,  
 tri-\*

bhū. Base of a geometric figure.

\*-māna,  
 sama-\*

bhūmi = bhū.

\*-kalpanā.

bheda. Variety (of assumption, equations).

kalpanā-\*,  
 madhyama-āharaṇa-\*

### m

mati = buddhi. Intellect, regarded by Bhāskara as the most essential element of the bīja-gaṇita. See BG Q2, Q11, 73a, 73p3, Q15. Cf. dhī.

\*-mat,  
 \*-vṛddhi,  
 amala-\*,  
 niścala-\*,  
 su-\*

madhya. Middle. Center.

- madhyama. Middle term.
- madhyama-āharaṇa. Elimination of the middle term of a quadratic equation, meaning the perfection of square, or the solution procedure for algebraic problems by means of it. The second item of *bīja-catuṣṭaya*.  
 aneka-varṇa-\*,  
 ekavarṇa-\*.
- mahat. Large.
- mā. Abbr. of *māṇikya* (ruby).
- māna. Measure, size. dimension, value.  
 \*-saṃjñā,  
 avyakta-\*,  
 uḍḍīma-\*,  
 karṇa-\*,  
 kalikā-\*,  
 kālaka-\*,  
 kālaka-nīlaka-\*,  
 nīlaka-\*,  
 pītaka-\*,  
 bhujā-\*,  
 bhū-\*,  
 yāvattāvat-kālaka-\*,  
 yāvattāvat-kālaka-bhujā-  
 koṭi-\*-ātmaka-kṣetra,  
 yāvattāvan-\*,  
 lamba-\*,  
 varga-aikya-\*,  
 varṇa-\*,  
 sama-rāśi-\*,  
 haritaka-\*.
- mita. Of such and such measure.
- miti. Value (of unknown numbers).  
 Number (of a certain commodity).  
 avyakta-\*,  
 ādya-\*,  
 māṇikya-amala-nīla-maukti-  
 ka-\*,  
 varṇa-\*.
- mithas. Mutually.
- milita. Added up.
- miśra. Accompanied by, increased by.
- mu. Abbr. of *muktā-phala* (pearl).
- √muc. To exclude.
- muhus. Repeatedly.
- mūla. Root (square and cube).  
 \*-abhāva,  
 \*-artha,  
 \*-ānāyana,  
 \*-aikya,  
 \*-karaṇa,  
 \*-karaṇī,  
 \*-dhana,  
 ananta-\*,  
 avyakta-\*,  
 āsanna-\*-karaṇa,  
 kaniṣṭha-\*,  
 karaṇī-gata-\*-abhāva,  
 kṛti-\*,  
 kṣetra-\*-antarbhūta,  
 guṇa-\*,  
 ghana-\*,  
 catuḥ-kṣepa-\*,  
 jyeṣṭha-\*,  
 trayodaśa-kṣepa-\*,  
 trayodaśa-ṛṇa-kṣepa-\*,  
 dvi-kṣepa-\*,  
 pakṣa-\*,  
 prakṛti-\*,  
 yoga-\*,  
 rāśi-\*,  
 rūpa-kṣepa-\*,  
 rūpa-śuddhi-\*,  
 vadha-\*,  
 varga-antara-\*,  
 varga-aikya-\*,  
 varga-\*,  
 varga-\*-prada,

viyoga-\*.  
 mūla-da. Giving the square root, a square number.  
 mūla-prada = mūla-da.  
 mūla-sūtra. Original rule. See BG 73p3 and the footnote thereon.  
 mūlya. Price.  
 mecaka. Dark blue. One of the words for unknown numbers; its initial letter, me, is used as a symbol. See BG 68p1.  
 maulya. Price.  
 aśva-\*,  
 tulya-\*,  
 ratna-\*,  
 vāji-\*

## y

yadi. If  
 yā. Abbr. of yāvattāvat. Symbol for the first unknown number.  
 \*-kāra.  
 yākābhā. Abbr. of yāvattāvat-kālaka-bhāvita.  
 yāgha. Abbr. of yāvattāvad-ghana.  
 yānībhā. Abbr. of yāvattāvan-nīlaka-bhāvita.  
 yāva. Abbr. of yāvattāvad-varga.  
 yāvakābhā. Abbr. of yāvattāvad-varga-kālaka-bhāvita.  
 yāvagha. Abbr. of yāvattāvad-varga-ghana.  
 yāvat. Abbr. of yāvattāvat.  
 \*-aṅka.  
 yāvattāvat. As much as, as many as. Word for the first unknown number; its initial letter, yā, is used as a symbol for it. See BG 7, 56, 58p2, 68p1.  
 \*-aṅka,  
 \*-unmāna,

\*-unmiti,  
 \*-kalpanā(-a),  
 \*-kālaka-māna,  
 \*-kālaka-varṇa,  
 \*-ghana,  
 \*-māna,  
 \*-rāśi,  
 \*-varga,  
 \*-varga-guṇa,  
 \*-varga-ghana,  
 \*-varga-varga.  
 yāvava. Abbr. of yāvattāvad-varga-varga.  
 yukta. Accompanied by, increased by.  
 \*-ūnī-karaṇa.  
 yukti. Reason, ground.  
 ityādi-\*,  
 vyakta-\*,  
 sad-\*.  
 -yuj. Increased by.  
 yuti. Addition, sum. Intersection.  
 kṛti-\*,  
 kṛti-*viyuti*,  
 ghana-varga-\*,  
 varga-\*,  
 sūtra-\*.  
 yoga. Sum.  
 \*-antara-kṣepaka,  
 \*-antara-ghāta,  
 \*-karaṇī,  
 \*-ghana,  
 \*-ja,  
 \*-ja-labdhi,  
 \*-pada,  
 \*-mūla,  
 ghana-\*,  
 ghana-varga-\*,  
 doḥ-koṭi-varga-\*,  
 bhujā-koṭi-varga-\*,  
 rāśi-\*,  
 rāśi-*kṛti*,



varga-antara-\*,  
varga-\*,  
sama-\*,  
sama-\*-viyoga.  
yojita. Added.

## r

rahita. Deprived of, decreased by.

rāśi. Quantity, number.

\*-antara,  
\*-kṣepa,  
\*-gata,  
\*-ghāta,  
\*-nihati,  
\*-mūla,  
\*-yoga,  
\*-yoga-kṛti,  
\*-vadha,  
\*-varga,  
\*-śeṣa,  
ananto \*(ḥ),  
avyakta-\*,  
avyakta-varga-\*,  
kalpita-\*,  
pūrva-\*,  
bhājya-\*,  
yāvattāvad-\*,  
varga-\*,  
sama-\*

-rāśika. See trairāśika, pañcarāśika.

rāśi-gata-upapatti. Proof based on quantities. See BG 93p3–p4.

rū. Abbr. of rūpa.

rūpa(ka). Unity. Collectively, a set of unity, i.e., an integer.

\*-ūna,  
\*-kṣepa,  
\*-kṣepa-artha-bhāvanā,  
\*-kṣepa-pada,  
\*-kṣepa-pada-artha,  
\*-kṣepa-pada-ānayana,

\*-kṣepa-pada-uttha,  
\*-kṣepa-bhāvanā,  
\*-kṣepa-mūla,  
\*-pada,  
\*-vat,  
\*-vidhāna-hetu,  
\*-viśodhana,  
\*-śuddhi,  
\*-śuddhi-pada,  
\*-śuddhi-mūla,  
\*-śeṣa,  
a-\*,  
avyakta-varga-\*,  
āhati-\*-aikya,  
ṛṇa-ga-\*-tas,  
ṛṇa-\*,  
kṣaya-\*,  
dhana-\*,  
varga-\*,  
vi-\*,  
vyakta-pakṣa-\*,  
vyakta-pakṣa-mūla-\*,  
vyakta-\*,  
vyeka-\*,  
sa-ayyakta-\*,  
sa-tri-\*,  
sa-dvi-\*,  
sa-pañca-\*,  
sa-\*,  
hāra-taṣṭa-\*

## l

laghu. Small.

\*-kṣetra.

labdha. Obtained in general, quotient in particular.

\*-aikya-pramāṇa,  
bhāga-\*

labdhi. Quotient.

\*-pramāṇa,  
\*-vaiṣamya,

dhana-\*,  
yoga-ja-\*.  
√labh. To obtain (a result by means  
of calculations).  
lamba. Perpendicular.  
\*-māna.  
lava. Part.  
tri-\*.  
lāghava. Easiness (of calculation).  
\*-artha,  
kriyā\*-artha.  
lābha. Quotient.  
kṣepa-takṣaṇa-\*,  
takṣaṇa-\*.  
lekhya. To be written down.  
lo. Abbr. of lohitaka. Symbol for the  
fifth unknown number.  
loka. People, who do not have convic-  
tion in negative known quanti-  
ties. See BG E69p.  
lohitaka (rarely lohita). Red. Word for  
the fifth unknown number; its  
initial letter, lo, is used as a  
symbol for it. See BG 7, 68p1.

## v

va. Abbr. of vajra (diamond).  
va. Abbr. of varga. See yāva, kāva,  
nīva, pīva.  
vajra-abhyāsa. Cross multiplication for  
varga-prakṛti.  
vadha. Product.  
\*-kṣepa,  
\*-mūla,  
bhujā-koṭi-\*,  
rāśi-\*.  
varga. Square.  
\*-antara,  
\*-antara-kṣepaka,  
\*-antara-mūla,  
\*-antara-yoga,

\*-artha,  
\*-aikya,  
\*-aikya-māna,  
\*-aikya-mūla,  
\*-tva,  
\*-yuti,  
\*-yoga,  
\*-rāśi,  
\*-rūpa,  
antara-\*,  
avyakta-\*,  
avyakta\*-ādisamīkaraṇa,  
avyakta\*-rāśi,  
avyakta\*-rūpa,  
kaniṣṭha-\*,  
kālaka-\*,  
ghana-\*,  
ghana\*-yuti,  
ghana\*-yoga,  
navātmaka-\*,  
nīlaka-\*,  
nīlaka\*-ghana,  
pītaka-\*,  
yāvattāvad-\*,  
yāvattāvad\*-\*,  
rāśi-\*,  
varṇa-\*,  
sama\*-gama.  
varga-ādi-gata. Raised to the powers  
beginning with the square.  
varga-kuṭṭaka. Square pulverizer:  
method for solving the equa-  
tion  $y = \frac{ax^2+c}{b}$ .  
varga-kṛti = varga-varga.  
varga-gata. Raised to the square  
power.  
varga-ghana. Cube of square, the sixth  
power.  
varga-prakṛti. Square nature or natu-  
ral form of square: method for  
solving the quadratic indeter-

- minate equation,  $px^2 + t = y^2$ ,  
where  $p$  is called prakṛti.
- varga-mūla. Square root.
- varga-mūla-prada. Giving a square  
root, a square number.
- varga-varga. Square of square, the  
fourth power.
- vargita. Squared.
- varjita. Deprived of, decreased by.
- varṇa. Color (for expressing unknown  
number).  
\*akṣara,  
\*aṅka,  
\*aṅka-āhati,  
\*ātmaka,  
\*kṛti,  
\*māna,  
\*varga,  
aneka-\*,  
aneka-\*madhyama-āharaṇa,  
aneka-\*samī-karaṇa,  
antya-\*,  
antya-\*māna,  
anya-\*,  
anya-\*unmiti,  
anya-\*kalpanā,  
anya-\*māna,  
anya-\*varga,  
ādyā-\*unmiti,  
ādyā-\*śeṣa,  
iṣṭa-\*,  
eka-\*unmiti,  
eka-\*tva,  
eka-\*madhyama-āharaṇa,  
eka-\*samī-karaṇa,  
kālaka-\*māna,  
pūrva-\*,  
pūrva-\*unmiti,  
pūrva-\*māna,  
prakṛti-\*,  
prakṛti-\*māna,  
prakṛti-\*miti,  
prathama-\*,  
prathama-\*miti,  
bhājaka-\*unmiti,  
bhājaka-\*māna,  
bhājya-\*,  
bhājya-\*māna,  
yāvattāvat-kālaka-\*,  
vividha-\*,  
vividha-\*sahāyana.
- vallī. 'Creeper,' indicating a column of  
quotients of the mutual divi-  
sions for kuṭṭaka with the ad-  
ditive and zero at its bottom.  
Cf. paraspara-bhajana.
- vi-. Less by.  
\*eka,  
\*eka-rūpa,  
\*pañca-rūpa,  
\*rūpa.
- vikalpa. Option.
- vikāra. Change (of form).
- vikraya. Selling rate (of commodity per  
price). Cf. kraya.
- vijātīya. Of a different category.
- vitta. Property.  
tulya-\*
- √vid. To know (calculation, answer,  
etc.).
- vid. Knowing about.  
bīja-\*
- vidha. Variety, kind.  
aneka-\*,  
evam-\*,  
evam-\*kalpanā,  
dvi-\*,  
ṣaḍ-\*
- vi-√dhā. To do, make (calculation,  
equation, etc.).
- vidhāna. Making (rūpa from karaṇī).  
rūpa-\*hetu.

- vidhi. Doing, making in general, mathematical operation in particular, and a procedure for it.  
 kuṭṭaka-\*,  
 khaṇḍagaṇanā-\*,  
 dhana-bhājya-\*,  
 manda-avabodha-\*,  
 viloma-\*,  
 śeṣa-\*,  
 samīkāra-\*.
- vinā. Without, excluding.
- vinighna. Multiplied.
- vinyas (vi-ni-√as). To put down, set down (numbers or figures on the calculating board).
- viparyas (vi-pari-√as). To reverse, interchange.
- viparyaya. Inverse.
- viparyāsa. Inversion, interchange.  
 cheda-aṁśa-\*.
- vibhakta. Divided.
- vi-√bhaj. To divide.
- vibhājita. Divided.
- vibhājya. To be divided.
- vibhinna. Different.  
 \*-jāti.
- viyuti. Difference.  
 kṛti-yuti-\*.
- viyoga. Difference.  
 \*-ja,  
 \*-mūla,  
 sama-yoga-\*.
- viyojita. Subtracted.
- viloma(ka). Inverse.  
 \*-utthāpana,  
 \*-utthāpana-prakāra,  
 \*-vidhi.
- vivara. Difference.
- vivarjita. Deprived of, decreased by.
- viśuddhi. Subtractive (number, term).  
 vi-√śudh = √śudh.
- viśeṣa. Peculiar, special. Difference.  
 \*-sūtra,  
 phala-\*-abhāva.
- viśodhana. Subtraction.  
 rūpa-\*.
- viśodhita. Subtracted.
- viśodhya. To be subtracted.
- vi-√śliṣ. Caus. To separate, decompose.
- viśleṣa. Disjunction, decomposition. Difference.  
 \*-sūtra.
- viśleṣya. To be separated, decomposed.
- viṣama. Uneven, odd (number). Scalene (triangle).  
 \*-tryasra.
- viṣaya. Object, area.  
 sūtra-ārtha-\*.
- vihṛta. Divided.
- vedin. Knowing about.  
 kuṭṭaka-\*.
- vaiparītya. Inversion.
- vaiṣamya. Unevenness, unequalness.  
 labdhi-\*.
- vyakta. Visible, known (number). Cf. avyakta.  
 \*-aṅka,  
 \*-tva,  
 \*-pakṣa-mūla-rūpa,  
 \*-pakṣa-rūpa,  
 \*-rūpa.
- vyakta-gaṇita. Mathematics with known numbers which does not employ bījas. Cf. avyakta-gaṇita.
- vyakta-pakṣa. The side of known numbers of an equation, which exclusively consists of known numbers. Cf. avyakta-pakṣa.
- vyatyaya. Inversion.  
 dhana-ṛṇa-tā-\*

vyatyāsa. Inversion.

dhana-ṛṇa-tva-\*,  
dhana-ṛṇa-\*

vyabhicar (vi-abhi-√car). To deviate from the right course (the subject is calculation).

vyabhicāra. Error, anomaly.

vyavakalana. Subtraction.

vyavahāra. Procedure.

kṣetra-\*

vyasta. Inverted, inverse.

\*-dhana-ṛṇa-ga.

vyāpti. Pervasion, validity of a rule or of a thesis.

### ś

śavalaka. Spotted. One of the words for unknown numbers; its initial letter, śa, is used as a symbol. See BG 68p1.

śāstra. Discipline (of mathematics).

\*-vistāra-vāri-dhi,  
\*-vistṛti.

√śudh. To become clean (when subtracted repeatedly), where the subject is a factor of the dividend. To become clean (when divided), where the subject is the dividend divisible by the divisor. Caus. to subtract.

śuddha. Subtracted.

śuddhi. Subtraction.

tulya-\*,  
rūpa-\*-pada,  
rūpa-\*-mūla,  
sama-\*

śūnya. Zero.

\*-eka-dvy-ādy-utthāpana,  
\*-tas.

śeṣa(ka). Remainder.

\*-avyakta,

\*-vidhi,

adhimāsa-\*,

avama-\*,

avyakta-rāśi-\*,

avyakta-\*,

ādyavarṇa-\*,

pakṣa-\*,

bha-gaṇa-\*,

bhāga-\*,

rāśi-\*,

rūpa-\*

śodhana. Subtraction.

\*-artha,

\*-ādi-siddha,

sama-\*,

sama-\*-artha.

śodhita. Subtracted.

śodhya. To be subtracted.

śyāmalaka. Black. One of the words for unknown numbers; its initial letter, śyā, is used as a symbol. See BG 68p1.

śravaṇa = karṇa.

śravas = karṇa.

śruti = karṇa.

śruti-pathāt. Diagonally.

śreḍhī. Mathematical series.

śreḍhī-gaṇita. 'Series computation,' meaning the sum of an arithmetical progression. See L 121.

śreḍhī-phala. The sum of a mathematical series.

śve. Abbr. of śvetaka. Symbol for the seventh unknown number.

śvetaka. White. Word for the seventh unknown number; its initial letter, śve, is used as a symbol for it. See BG 68p1.

ṣaḍ-gata. Raised to the sixth power.  
 ṣaḍ-vidha. Six kinds (of arithmetical operations, which are treated in the first four chapters of the BG).

## s

sa-. Accompanied by, increased by.

- \*-ardha,
- \*-alpa,
- \*-avyakta,
- \*-avyakta-rūpa,
- \*-aṣṭa(ka),
- \*-upapatti-prakāra,
- \*-eka,
- \*-ekaviṃśati,
- \*-kalā-antara,
- \*-kṣepa,
- \*-tri-rūpa,
- \*-dvi-rūpa,
- \*-pañca-rūpa,
- \*-phala,
- \*-bhāvita,
- \*-rāśi-yugala,
- \*-rūpa(ka),
- \*-rūpa-aṣṭaka,
- \*-viśva-rūpa,
- \*-sūtra-uddeśaka.

saṃkalana(or ā). Addition, summation.

saṃkalita. Added up, sum.

saṃkoca. Contraction (of calculation).  
 kriyā-\*

saṃkramaṇa. Rule of concurrence. See L 56.

saṃkṣipta. Abridged.

- \*-pāṭha.

saṃkhyā. Number.

- ali-\*,
- alikulā-\*,
- aśva-ādi-\*,

khaṇḍa-\*,

bāṇa-\*,

ratna-\*.

saṃkhyāna. Calculation.

saṃguṇa. Multiplied.

saṃguṇ (sam-√guṇ). To multiply.

saṃguṇita. Multiplied.

saṃjñā. Name, designation.

bīja-gaṇita-\*,

māna-\*.

saṃdheya. To be united, reconciled.

saṃpāta. Intersection.

sūtra-\*.

saṃyuj (sam-√yuj). To unite, add.

saṃyuta. Accompanied by, increased by.

saṃyuti. Sum

saṃvargita. Squared.

saṃśudh (sam-√śudh). Caus. to subtract.

saṃśliṣṭa-kuṭṭaka. Contiguous kuṭṭaka, an indeterminate system of simultaneous linear equations,  $a_i x = b y_i + r_i$ . See BG 39.

sakala. Whole.

\*-gaṇita-sāra.

sakṛt. Only once (equation made).

sadrśa. Same, equal.

sama. Same, equal.

\*-argha,

\*-kṣepa,

\*-gati,

\*-ccheda,

\*-cchedī-kṛta,

\*-cchedī-kṛtya,

\*-jātika,

\*-tā,

\*-tva,

\*-dhana,

\*-paṇa,

\*-yoga,

- \*-yoga-viyoga,  
 \*-rāśi-māna,  
 \*-śuddhi,  
 kṛta-\*-cheda,  
 guṇaka-khaṇḍa-\*,  
 prakṛti-\*-kṣepa.
- sama-kriyā. Equality operation, equation procedure, operation with equations.
- sama-catur-asra-kṣetra. A figure with four equal sides, a square.
- sama-cchedī-karaṇa. Reduction (of fractions) to a common denominator.
- sama-varga-gama. Elimination of the same square (from both sides of an equation).
- sama-śodhana. Equal subtraction, subtraction of the same (from both sides of an equation).
- samanvita. Accompanied by, increased by.
- samapavartita. Reduced by a common factor.
- sam-ā-√gam. To come near, obtain.
- samāna. Same.  
 \*-jāti.
- samāpta. Reached, obtained.
- samāsa. Sum.  
 \*-antara-bhāvanā.
- samāsa-bhāvanā. Generative method by sum. Essential part of varga-prakṛti. See bhāvanā.
- samīkaraṇa. Making equal (pakṣas or 'wings'), equation.  
 \*-artha,  
 aneka-varṇa-\*,  
 avyakta-varga-ādi-\*,  
 eka-varṇa-\*.
- samīkāra. Making equal (pakṣas or 'wings'), equation.
- \*-vidhi.
- samī-√kṛ. To equate.
- samīkṛta-ccheda-gama. Elimination of the denominators of fractions after reducing them to a common denominator.
- samutthā (sam-ud-√sthā). Caus. to raise. See utthā and utthāpana.
- samuddhṛta. Divided.
- sammita. Of such and such measure.
- sarva. All, every.  
 \*-karaṇī-tulya,  
 \*-dhana.
- sahāya(na). Companion.  
 vividha-varṇa-\*.
- sahita. Added up. Accompanied by, increased by.
- √sādh. Caus. to establish, obtain.
- sādhanīya. To be established, obtained.
- sādhita. Established, obtained.
- sādhya. To be established, obtained.
- sāmīya-karaṇa. Making equality, equation.
- sāra. Essence.  
 sakala-gaṇita-\*.
- √sidh. To be established, settled.
- siddha. Established, settled.  
 \*-anta,  
 \*-anta-śiro-maṇi.  
 śodhana-ādi-\*.
- siddhi. Establishment, settlement.  
 iṣṭa-\*.
- su-. Good.  
 \*-dhī,  
 \*-buddhi,  
 \*-mati.
- sūtra. Thread.  
 \*-yuti,  
 \*-sampāta.

sūtra. Rule.

\*-artha-*viṣaya*,  
 \*-avatāra,  
 ityādi-\*,  
 karaṇa-\*,  
 para-ukta-\*,  
 pūrva-ukta-\*,  
 mūla-\*,  
 viśeṣa-\*,  
 viśleṣa-\*,  
 śrīdhara-ācārya-\*,  
 sa-uddeśaka.

stoka. Small, little.

\*-buddhi.

-stha. Being at, lying at.

koṇa-\*,  
 dvi-\*,  
 bahiḥ-koṇa-\*,  
 bhājya-\*

sthāna(ka). Place.

sthāpya. To be placed.

stṛiti. Standing (of numbers, terms,  
 etc.).

pr̥thak-\*

sthira-kuṭṭaka. Fixed (or constant) ku-  
 ṭṭaka, where the additive is  
 taken to be positive or nega-  
 tive unity:  $y = \frac{ax \pm 1}{b}$ . See BG  
 36cd–37ab.

sphuṭa. Correct.

\*-kuṭṭaka.

sva. Property, positive quantity.

\*-tva,  
 \*-r̥ṇa-ga.

sva-tas. Automatically (established).

svayam. Automatically (established).

sva-rūpa. True constitution.

hata. Multiplied.

hati. Product.

√han. To multiply.

hara. Divisor.

\*-taṣṭa,  
 eka-*tva*,  
 kha-\*,  
 kha-*tva*.

haraṇa. Dividing, division.

haritaka. Green. Word for the sixth  
 unknown number; its initial  
 letter, ha, is used as a symbol  
 for it. See BG 68p1.

\*-māna.

hā. Abbr. of hāra.

√hā. To leave, exclude.

hāra. Divisor.

\*-taṣṭa,  
 \*-taṣṭa-rūpa,  
 kha-\*,  
 dṛḍha-bhājya-\*,  
 bhāga-\*

hīna. Less by.

√hr̥. To divide.

-hr̥t. Divisor.

hr̥ta. Divided.

hetu. Reason, cause.

karaṇī-*tva*-\*,  
 kriyā-\*,  
 rūpa-vidhāna-\*

hrasva. Small. Smaller (of the two  
 roots).

\*-jyeṣṭha-pada,  
 \*-pada.

## h

ha. Abbr. of haritaka. Symbol for the  
 sixth unknown number.



### III.4 Bhūtasamkhyās and Weights and Measures

#### III.4.1 Bhūtasamkhyās

For rūpa meaning ‘unity’ and śūnya meaning ‘empty’ or zero see Appendix 6 (Index to Words).

0

kha E5a, E5b, 5c, 5d, E5c, 6a, 28d, E64a, E64d, E65b, E65c, <Q4a-d>, Q5b, viyat 5c,

1

indu E77c, kṣiti E77b, bhū E77b, mahī E77c,

2

netra E77c, yuga E59a, yugala E108b, Q13b yugma E6b, E7b, E7c, 29b, E58c, E108c,

3

guṇa E77a, pāvaka E77b, hutāśana E17b

4

śruti E77b,

5

iṣu E19a,

6

aṅga E77a, ṛtu E19b,

7

muni E77b, E77c,

8

gaja E16b,

nāga E19b, maṅgala E77a,

11

rudra E19a,

12

ravi E98b, sūrya E19a,

13

viśva E17b, E19c,

14

indra E109c, manu E56b,

15

tithi 23b, E17b, E19a, E73a,

20

nakha E73a, E107b,

24

siddha E16b,

27

bha E11a,

32

danta E16b,

#### III.4.2 Weights and Measures

Units of currency

kākiṇī (= 1/4 paṇa) E48b, E48p

dramma (= 16 paṇas) E48a, E48p,

E79a

paṇa (= 4 kākiṇīs) E88d, E88e,

E88p1

Units of length

aṅgula (= 1/12 vitasti) E70c,

E70p1

kara (= hasta) E57d, E60a

pāṇi (= hasta) E57a

vitasti (= 12 aṅgulas) E58b  
 hasta (= 2 vitastis) E57c, E58c,  
 E58p, E59a

Unit of length of writing

anuṣṭubh (= 32 syllables) 97a

Units of time

ahan (civil day) 38p1(-gaṇa)  
 indu-divasa (lunar day) 38d  
 kalpa (= 1,000 yugas) 38p1, 38p2  
 ku-dina (civil day) 37d, 38p1  
 cāndra-divasa (lunar day) 38p3  
 māsa (= 1/12 varṣa) E42p1,  
 E42p3, E46c, E46p  
 yuga (= 4,320,000 solar years)  
 38p3  
 ravi-dina (solar day) 38p2  
 ravi-divasa (solar day) 38d, 38p2  
 varṣa (= 12 māsas) E45b

Units of arc

kalā (= 60 vikalās) 38p1  
 bha-gaṇa (= 12 rāśis) 38p1  
 bhāga (= 60 kalās) 38p1  
 rāśi (= 30 bhāgas) 38p1  
 lava (= bhāga) 38b  
 liptā (= kalā) 38b  
 vikalā (= 1/60 kalā) 38a, 38p1

### III.5 Index to Quarter Verses

For the order of the Indian letters see Appendix 3. Interword space and avagraha are ignored.

.....

akhile kṛtimūlābhyām 51a  
agraikyam agram kṛta uktavad yaḥ 39c  
ato bījam pravakṣyāmi 55c  
ato mandārtham ucyate Q15d  
atrānuṣṭupsahasraṃ hi 97a  
atraikādhikavarṇasya 69a  
athavā bhāgahāreṇa 34a  
athavālpam śeṣakam yathā 47d  
athavā śāstravistrītyā 99c  
adhiṣṭhitam satpuruṣeṇa sāmkyāḥ 1b  
anante 'cyute bhūtagaṇeṣu yadvat 6d  
analpā kalpanā yataḥ Q2d  
antyonmitau kuṭṭavidher guṇāptī 66c  
anyagacche bhaved vada E93d  
anyato bhāvitānkena 92c  
anyapakṣarṇarūpataḥ Q6b  
anyāṃśadvayahīnā ye E49c  
anyān rūpāṇy anyataś cādyabhakte 65b  
anye 'pi bhājye yadi santi varṇās 67a  
apavarte yā labdhā 25a  
api praviṣṭeṣv api nissṛteṣu 6b  
abhinnam syād yathā tathā 87d  
abhinne bhavataḥ pade 49d  
abhīpsitakṣepaviśuddhinighnyau 37a  
abhyāso ghanakuṭṭake E104d  
alikuladalamūlam mālatim yātam aṣṭau E61a  
alpaṃ dhanarṇagam kṛtvā Q6c  
avāptayaś cāpi śeṣasamāḥ E81d  
avikṛta eva vicintyaḥ Q5c  
avyaktam tatra tanmānam 87c  
avyaktapakṣo 'sya padena bhūyaḥ 59d  
avyaktam īsam gaṇitam ca vande 1d  
avyaktamānam khalu labhyate tat 60b  
avyaktamānam dvididham kvacit tat 61d  
avyaktamūlarnagarūpato 'lpam 61a  
avyaktavargakaraṇīgunānāsu cintyo 10c

avyaktavargarūpair Q3c  
 avyaktavargādi yadāvaśeṣaṃ 59a  
 avyaktavargo 'tra kṛtiprakṛtyā 74c  
 avyaktānāṃ kalpitā mānasaṃjñās 7c  
 avyaktānāṃ dvyādikānāṃ apīha 58a  
 avyaktānāṃ brūhi vargaṃ sakhe me E8f  
 avyaktā rāśayaḥ kalpyāḥ Q7c  
 aśvāḥ pañcaguṇāṅgamaṅgalamitā yeṣāṃ caturṇāṃ dhanāny E77a  
 aśvā daśānyasya tu tulyamaulyāḥ E36b  
 aṣṭādaśa hatāḥ kena E24a  
 aṣṭādaśāṣṭadvikasammitānāṃ E14a  
 aṣṭau ṣaṭpañcāśat E18a  
 asamānasamacchedān E52a  
 asti trairāśikaṃ pāṭī Q15a  
 asmin vikāraḥ khahare na rāśāv 6a  
 ācāryavaryapadavīm viduṣāṃ prapannaḥ 95b  
 ādāya tatsāram akāri nūnaṃ 96c  
 ādāyārpaya taṇḍulāṃśayugalaṃ mudgaikabhāgānvitaṃ E48c  
 āder dalam tatpracayaḥ phalaṃ ca E63b  
 ādyaṃ varṇaṃ śodhayed anyapakṣād 65a  
 ādyayukto navonitaḥ E64b<sup>2</sup>  
 ādyāyukto 'thavonitaḥ E64b<sup>3</sup>  
 ādyo dhanena triguṇo 'nyato vā E37c  
 ārabhyate yathā laghvī 86c  
 ārūḍho vada te kati E69d  
 ālāpita eva haro 90c  
 ālāpo matir amalā- Q11a  
 āsīn maheśvara iti prathitaḥ pṛthivyām 95a  
 itaretaramūlāgraga- E60c  
 iti bahugūṇayuktaṃ sarvadoṣair vimuktaṃ 102c  
 iṣṭaṃ hrasvaṃ tasya vargaḥ prakṛtyā 40a  
 iṣṭabhakto dvidhā kṣepa 54a  
 iṣṭavargaprakṛtyor yad 45a  
 iṣṭavargahṛtaḥ kṣepaḥ 44a  
 iṣṭāhatasvasvahareṇa yukte 36a  
 iṣṭoddhṛtasyeṣṭavivarjitasya 80c  
 iṣṭonāḍhyo dalikṛtaḥ 54b  
 uktaṃ bījopayogīdaṃ 55a

<sup>2</sup>Cf. 'ādyāyukto 'thavonitaḥ' and 'koṭyā yukto 'thavonitaḥ.'

<sup>3</sup>Variant of 'ādyayukto navonitaḥ.'

uttīryātha paro drutaṃ śrutipathāt proḍḍīya kiñcid drumāt E59b  
 utpatsyamānayaivaṃ 24a  
 utpādakam yat pravadanti buddher 1a  
 upadeśalavaṃ śāstram 100a  
 upapattiyutaṃ bīja- 94a  
 upapattiś ca rūḍhasya E73c  
 uṣṭrās ca dvimuniśrutikṣitimitā aṣṭadvibhūpāvākāḥ E77b  
 ūrdhvo vibhājyena dr̥dhena taṣṭaḥ 29c  
 ṛṇam tathā rūpaśataṃ ca tasya E36c  
 ṛṇam dhanam tac ca vidhāya sādhyam 61c  
 ṛṇam dhanena svam ṛṇena kiṃ syād E3c  
 ṛṇagaiḥ pañcabhiḥ kṣuṇṇaḥ E35a  
 ṛṇabhājya ṛṇakṣepe Q0a  
 ṛṇātmikā cet karaṇī kṛtau syād 21a  
 ṛṇātmikāyās ca tathā karaṇyā 15c  
 ekaḥ pañcadaśānyas E56c  
 ekakaśatadattadhanāt E43a  
 ekam eva matir bījam Q2c  
 ekaviṃśatīyutaṃ śatadvayaṃ E21a  
 ekasya pakṣasya pade gṛhīte 74a  
 ekasya rūpatrīśatī ṣaḍ aśvā E36a  
 ekasyānyatarasya sapta nava ṣaṭ tadratnasamkhyā sakhe E38b  
 ekāgro dvihṛtaḥ kaḥ syād E82a  
 ekādaśaguṇaḥ ko vā E28c  
 ekādaśayutāt padam E72b  
 ekādisamkalitamita- 22a  
 ekāvyaktaṃ śodhayed anyapakṣād 57a  
 ekaiva yāvat karaṇī hare syāt 16d  
 eko bāhuḥ paraś ca ṣaṭkaraṇī E51b  
 eko bravīti mama dehi śatam Q9  
 eko bravīti mama dehi śatam dhanena E39a  
 eko haraś ced guṇakau vibhinnau 39a  
 etābhyāṃ samyutāv ūnau 93a  
 evaṃ kṛtiprakṛtir atra niyojanīyā 75d  
 evaṃ tadā jñeyam idaṃ svabuddhyā 60d  
 evaṃ tadūrdhvaṃ ca tathādhimāsā 38c  
 evaṃ tadaivātra yadā samās tāḥ 30a  
 evaṃ sahasradhā gūḍhā 81a  
 eṣāṃ pārāvatādīnāṃ E79c  
 kaḥ krayo vikrayās ca kaḥ E88f  
 kaḥ khena vihr̥to rāsir E64a

kaḥ pañcagūṇito rāśis E87a  
 kaḥ pañcanighno vihr̥tas triṣaṣṭyā E27a  
 kaḥ saiko mūlado vada E32b  
 kaḥ svārdhasahito rāśiḥ E65a  
 katham̐ sā vā pravartate Q10d  
 kathaya katiṣu mūlād eṣa bhagnaḥ kareṣu E57d  
 kaniṣṭham ādyena padena tulyam̐ 78c  
 kaniṣṭhavargeṇa tadā nihanyāj 77a  
 kayoḥ syād antare vargo E92a  
 karaṇīkhaṇḍāni vargarāśau syuḥ 22b  
 karaṇīdvitayasya tulyarūpāni 22d  
 karaṇīṣaṭke tistr̥ṇām 23a  
 karaṇyau bhujayor mitī E50b  
 karṇasya trilavenonā E70a  
 kartavyau svecchayā ca tau 93b  
 kalpyātha śuddhir vikalāvaśeṣam̐ 37c  
 kalpyāni mānāni tathepsitāni 91b  
 kalpyo 'nyavarṇavargādis 87e  
 kas trayodaśavarjitaḥ E34b  
 kas trayoviṃśatikṣuṇṇaḥ E86a  
 kas trisaptanavakṣuṇṇo E85a  
 kā kṛtir navabhiḥ kṣuṇṇā E33a  
 kā caikaṣaṣṭīnihatā ca sakhe sarūpā E29b  
 kānte ketakamālatīparimalaprāptaikakālapriyā- E41c  
 kā saptāṣaṣṭigūṇitā kṛtir ekayuktā E29a  
 kiṃ kāryam̐ sudhiyām̐ api 99d  
 kiṃ mūlam̐ brūhi tasya syāt E16d, E17d, E18d  
 kiṃ syāt khayuktaṃ vada khāccyutaṃ ca E5b  
 kiṃ syāt teṣām̐ guṇanajaphalam̐ guṇyabhaktaṃ ca kiṃ syād E10c  
 kim̐ ajñātaṃ subuddhīnām̐ Q15c  
 kuṭṭakajña vadāsu tam̐ E86d  
 kurute dhīmato yataḥ 100b  
 kuryād bhūyo 'parām̐ kriyām̐ 85b  
 kṛtiḥ syād gaṇakocyatām̐ E28b  
 kṛtiḥ svarṇayoḥ svam̐ svamūle dhanarṇe 4c  
 kṛtiprakṛtyādyamitis tathā ca 72b  
 kṛtibhya ādāya padāni teṣām̐ 12a  
 kṛtīkṛtānām̐ ca sakhe padāni E14b  
 kṛtvā kalpyo guṇas tatra 47a  
 kṛtvā kṛtyādinā samam̐ 84d  
 kṛtvā tadīyakṛtayaḥ khalu pūrvalabdhyā 18c

- kṛtvā padaṃ tasya tadanyapakṣe 78a  
 kṛtvāparaṃ pakṣam athānyamānaṃ 72a  
 kṛtyāpavartyātra pade prasādhye 76b  
 kṛtvā pūrvapadaṃ samam 85d  
 kṛtvābhinnam avehi vatsa gaṇakaḥ kas tvatsamo 'sti kṣitau E108d<sup>4</sup>  
 kṛtvoktavat prathamavarṇamitiḥ prasādhyā 75b  
 kṛpayā kalpanopāyas 81c  
 kenāpy ādau sambhave kuṭṭakārtham 26b  
 koṭikarṇāntaraṃ sakhe E74b  
 koṭyā yukto 'thavonitaḥ E64b<sup>5</sup>  
 ko rāśir dviguṇo rāśi- E89a  
 ko rāśir dviśatikṣuṇṇo E67a  
 ko rāśis triṃśatā hṛtaḥ E84b  
 ko rāśis tribhir abhyastaḥ E101a  
 ko vargaḥ ṣaḍguṇas tryāḍhyo E31a  
 ko vargaḥ saikaviṃśatiḥ E35b  
 ko vargaś caturūnaḥ san E103a  
 ko vargo 'ṣṭahataḥ saikaḥ E28a  
 ko vā caturguṇo vargas E33c  
 ko vāṣṭaguṇito vargo E30c  
 kau rāśī vada pañcaṣaṭkavihṛtāv ekadvikāgrau yayor E83a  
 kriyā vyabhicaret tathā 69d  
 kṛtvā samārghena phalāni ye E88b  
 kvacic ca kalpanābhedaṃ 98a  
 kvacit sūtrārthaviṣayaṃ 97c  
 kvacid antyāt kriyā budhaiḥ 86b  
 kvacid ādeḥ kvacin madhyāt 86a  
 kvacid yuktim udāhṛtam 98b  
 kṣayaṃ dhanam vā sahitaṃ vadāsu E1b  
 kṣayagaprakṛtau vidhim E35d  
 kṣayagaikādaśodhṛtāḥ E24d  
 kṣayasya ca brūhi sakhe mamāsu E4b  
 kṣayātmikaikā sudhiyāvagamyā 21d  
 kṣayāvvyaktayugmena yuktaṃ ca kiṃ syāt E7b  
 kṣayo bhavec ca kṣayarūpavargaś 15a  
 kṣayo bhāgahāre 'pi caivaṃ niruktam 4b  
 kṣiped dharaṃ teṣu hārataṣeṣu 89b  
 kṣipraṃ kṣiprabhujo vrajema hi yataḥ sārtho 'grato yāsyati E48d

<sup>4</sup>Variant of 'tac cābhinnam avehi vatsa gaṇakaḥ kas tvatsamo 'sti kṣitau.'

<sup>5</sup>Variant of 'ādyayukto navonitaḥ.'

kṣuṇṇaḥ kṣuṇṇe tadā pade 44d  
 kṣuṇṇā jyeṣṭhābhyāsayug jyeṣṭhamūlaṃ 42c  
 kṣuṇṇā bhavanti pṛthag evam imāḥ karaṇyaḥ 18d  
 kṣuṇṇeṣu hr̥teṣu keṣu vimśatyā E81b  
 kṣuṇṇo yukto varjito vā sa yena 40b  
 kṣetre tithinakhais tulye E73a  
 kṣepaṃ viśuddhiṃ parikalpya rūpaṃ 36c  
 kṣepaḥ śudhyed dharoddhṛtaḥ 35b  
 kṣepaḥ syād iṣṭabhājite 44b  
 kṣepataksaṇalābhādhyā 33c  
 kṣepaś cet tad duṣṭam uddiṣṭam eva 26d  
 kṣepas tathānte kham upāntimena 28d  
 kṣepābhāvo 'thavā yatra 35a  
 kṣepo harahr̥taḥ phalam 35d  
 kṣepyaṃ tayor yena padapradaḥ syād 59c  
 khaṃ hāraś cet punas tadā rāśiḥ Q5b  
 khagunaś cintyaś ca śeṣavidhau Q4d  
 khaguno navatir bhavet E64d  
 khaguno vargito yutaḥ E65b  
 khaṇḍatraye 'pi saphalaṃ vada khaṇḍasaṃkhyām E46d  
 khaṇḍāni tatkr̥tipadasya yathepsitāni 18b  
 khaṇḍais tribhir navatiryuk trisatī dhanam tat E46b  
 khayoge viyoge dhanarṇam tathaiva 5a  
 khaharaḥ syāt khagunaḥ kham Q4c  
 khahāro bhavet khena bhaktaś ca rāśiḥ 5d  
 gacche kvāpi ca yat phalam E93b  
 gaṇaka pavanavegād ekadeśe sa bhagnaḥ E57b  
 gaṇaka brūhi tām drutam E70d  
 gaṇaka bhaṇitiramyam bālalīlavagamyam 102a  
 gaṇakānandakārakam 55d  
 gaṇayitvā kathaya yadi vetsi E99d  
 gaṇitam gaṇakā jaguḥ 94b  
 gaṇitajña vadāsu tam E89d, E91d  
 gaṇitasyāsyā kathyatām E73d  
 gaṇaḥ prāgvat tato labdhiḥ 34c  
 gaṇamūlahṛtaś cādyo 54c  
 gaṇalabdhiḥ padaṃ hrasvaṃ 48c  
 gaṇalabdhi tu pūrvavat 33b  
 gaṇalabdhyos samaṃ grāhyam 32e  
 gaṇavarge prakṛtyone 47c  
 gaṇāptī sto viyogaje 32b



- guṇā vargaśatonitā E91b  
 guṇitaṃ yadi jāyate 87b  
 guṇo 'thavā tryarkamite karaṇyau E12d  
 guṇyaḥ pṛthag guṇakakhaṇḍasamo niveśyas 10a  
 guṇyas trisaṅkhyā ca sapañcarūpā E12b  
 guṇyasyātha prakathaya kṛtiṃ mūlam asyāḥ kṛteś ca E10d  
 grāhyaṃ ced anyathā na sat kvāpi 23d  
 ghanamūlaṃ kṛtibhūtaṃ E101c  
 ghanavargayutir vargo E95a  
 ghanaikyam jāyate vargo E55a  
 ghātaḥ saptahrtaḥ ṣaḍagra iti tau ṣatkāṣṭakābhyāṃ vinā E83c  
 ghātasya mūlaṃ dviguṇam laghuṃ ca 13b  
 ghātāś caṣṭādaśānvitāḥ E71d  
 ghātena sadṛṣaṃ bhavet E109b  
 ghāto yaś ca jyeṣṭhayos tadviyogo 43c  
 cakrakrauñcākulitasalile kvāpi drṣṭaṃ tadāge E58a  
 cakravālam idaṃ jaguḥ 49b  
 caturāhatavargasamaiḥ Q3a  
 caturuddhṛtas trikāgro E80c  
 caturguṇasya ghātasya 64a  
 caturguṇāḥ sūryatithīsurudra- E19a  
 caturdaśāgro vada rāśim enam E27d  
 caturdaśāṅgulā jātā E70c  
 caturdvikṣepamūlābhyāṃ 50a  
 caturdviekayutāv evam 49c  
 catustriguṇayo rāśyoḥ E106a, Q12a  
 catvāriṃśadaśīti- E20a  
 catvāriṃśad yutir yeṣāṃ E75a  
 catvāro rāśayaḥ ke te E71a, E107a  
 cayādigacchābhihātiḥ svasapta- E63c  
 cicchedāsyā śīraḥ śareṇa kati te yān arjunas saṃdadhe E62d  
 cet ṣaḍvidhaṃ vetsi sakhe karaṇyāḥ E11d, E15d  
 cet santi rūpāṇi tathaiva śeṣam 12d  
 cet sādhyate 'sau karaṇitvahetoḥ 15b  
 ced vargavargeṇa kṛto 'pavartaḥ 76d  
 cyutaṃ śūnyatas tad viparyāsam eti 5b  
 chede karaṇyā asakṛd vidhāya 16b  
 jale tailaṃ khale guhyaṃ 101a  
 jātāḥ pañcadaśocyatām E65d  
 jātāḥ samapaṇās teṣāṃ E88e  
 jātās tulyadhanāḥ pṛthag vada sakhe tadratnamaulyāni me E44d

jātaivam samatā tayor yadi gatāv uḍḍīnamānaṃ kiyad E59c  
 jñātavye te viparyayāt 93d  
 jñātum śakyā mandadhībhir nitāntaṃ 2c  
 jñeyaḥ śūnyaṃ guṇas tatra 35c  
 jyeṣṭhaṃ kaniṣṭhena tadā nihanyāc 76c  
 jyeṣṭhaṃ kṣepo 'trāpi ca kṣepaghātaḥ 43d  
 jyeṣṭhaṃ tataḥ pūrvavad eva śeṣam 77b  
 jyeṣṭhaṃ tayoh prathamapakṣapadena tulyaṃ 75a  
 jyeṣṭhaṃ dvitīyena samaṃ vidadhyāt 78d  
 taṃ guṇaṃ gaṇaka kīrtayāsu me E26d  
 taṃ guṇaṃ gaṇaka me pṛthag vada E23d  
 taṃ vadāsu tavālaṃ ced E104c  
 tac cābhinnam avehi vatsa gaṇakaḥ kas tvatsamo 'sti kṣītau E108d<sup>6</sup>  
 tajaṃ phalaṃ syur vikalā guṇas tu 38a  
 tajjena bījagaṇitaṃ laghu bhāskareṇa 95d  
 tataḥ pakṣau vibhajya ca 92d  
 tato jyeṣṭham ato 'sakṛt 48d  
 tato jyeṣṭham ihānantiyaṃ 46a  
 tato rūpaviśodhane 51d  
 tat tu kṣepahrtaṃ kṣepo 48a  
 tat tu prāpyaiva vistāraṃ 100c  
 tattulyavitto yadi vā dvitīyaḥ E37b  
 tat padaṃ syād ekasamyutau 45d  
 tatpadena vibhājayet 53d  
 tatra kṛtau kiṃ padaṃ brūhi E20d  
 tatra tanmānam ānayet 84b  
 tatrābhyāsaḥ kṣepayoh kṣepakāḥ syāt 42d  
 tatrechayaikāṃ prakṛtiṃ prakalpya 79b  
 tatsaṅkhyānaṃ kartum ācāryavaryaiḥ 7d  
 tathā prakṛtitaś cyute 47b  
 tathā yathā praṣṭur abhīpsitāḥ syuḥ 17d  
 tathā sudhībhir bahudhā vicintyaṃ 72d  
 tadanyavarṇonmitayaḥ prasādhyāḥ 66b  
 tadartham atra kathyate 81d  
 tadā guṇaikyaṃ parikalpya bhājyaṃ 39b  
 tadānyavarṇasya kṛteḥ samaṃ tam 71d, 77d  
 tad eva triguṇaṃ kasminn E93c  
 tadbhāvitaṃ cāsama-jātighāte 9b  
 tadratnatrayamaulyasaṃyutimitis tryūnaṃ śatārdhaṃ priye E40c

<sup>6</sup>Cf. 'kṛtvābhinnam avehi vatsa gaṇakaḥ kas tvatsamo 'sti kṣītau.'

tadvat kṣepa ṛṇagate Q0c  
 tadvad eva hi labdhayaḥ E82d  
 tanmānam iṣṭam parikalpya sādhye 67b  
 tanmūlaguṇito yogaḥ E96c  
 tanmūlam ādāya ca śeṣakasya 80b  
 tayoh samīkāravidhiḥ punasā ca 71b  
 tayor bhāvanayānantyaṃ 53a  
 taṣṭayoh kṣepabhājyayoh 34b  
 tasmin magnaṃ gaṇaka kathaya kṣipram ambupramāṇam E58d  
 tasyārdhena nivārya taccharagaṇaṃ mūlais caturbhir hayān E62b  
 tādrkchidā bhājyaharau nihanyād 16c  
 tān anyān vādho niveśya krameṇa 41b  
 tāvad yāvad vargo 89c  
 tāsām kṛtiṃ tridvikasaṃkhyayoś ca E13b  
 tāsām kṛtiṃ brūhi kṛteḥ padaṃ ca E15c  
 tithiviśvahutāśanaiś caturguṇitaiḥ E17b  
 tulyaḥ kālaḥ phalaṃ ca tayoh E42d, E43d  
 tulyaḥ śeṣaṃ yathoktavat 87f  
 tulyā daśarūpādhyāḥ E17c  
 tulyāni rūpāṇy athavā bahūnām 19b  
 tulyau pakṣau sādhanīyau prayatnāt 56c  
 tenāpavartena vibhājitau yau 27c  
 tenāhato 'nyavarṇo 88c  
 tenotthāpyotthāpayed vyastam ādyān 68b  
 te bhājyatadbhājakavarṇamāne 66d  
 te vā bhavetām bahudhā guṇāptī 36b  
 teṣām aśvatarā vṛṣā munimahīnetrendusaṃkhyāḥ kramāt E77c  
 teṣām aikyapadaṃ sarāśiyugalaṃ jātā trayoviṃśatiḥ E108b, Q13b  
 taiḥ khaṇḍakaiḥ kramahataḥ sahito yathoktyā 10b  
 toyād ūrdhvaṃ kamalakalikāgraṃ vitastipramāṇam E58b  
 tau ced vetsi tadāhaṃ tvām E55c  
 tau tulyavittau ca kim aśvamaulyam E36d  
 tau bhājyahārau dṛḍhasaṃjñakau staḥ 27d  
 tau rāśī kathayābhinnau E92c  
 tau rāśī kathayāśu niścalamate ṣatkāṣṭakābhyām vinā E97d  
 tau rāśī vada komalāmalamate ṣaṭ sapta hitvā parau E98d  
 tau rāśī vada yatkrtyoh E94a  
 tau rāśī vetsi ced vada E106d, E110d  
 tau rāśī śīghram ācakṣva E54c  
 tyaktvā kṣiptvā vāpi saṃguṇya bhaktvā 56d  
 tyaktvā pūrvapadakṣepāms 49a

tyaktvā varṇau sarūpakau 92b  
 tyajen muhuḥ syād iti rāsiyugmam 29b  
 trayastrimśadyutaḥ kṛtiḥ E33d  
 trayād dvayaṃ svāt svam ṛṇād ṛṇaṃ ca E2a  
 trayodaśaguṇo vargaḥ E34a  
 trayodaśaguṇo vargo E30a  
 trayodaśa tathā pañca E50a  
 trayodaśayuto vā syād E34c  
 trayodaśa vadāvalambakaṃ tatra E56d  
 trayodaśavibhājitaḥ E87b  
 trayodaśa sakhe jātaṃ E72c  
 trayoviṃśatisaṃyutāḥ E25b  
 triṃśaj jātaṃ vadāśu tam E87d  
 triṃśadūno 'thavā kaḥ syād E103c  
 trikāgraḥ pañcabhir bhaktas E82c  
 trikādidvyuttaraśreḍhyāṃ E93a  
 trinighnam ādyaṃ vada tat kiyad dhanam E47d  
 tripañcaguṇarāśibhyāṃ E110a  
 tribhiḥ pārāvataḥ pañca E78a  
 triyuktaḥ ṣoḍaśodhṛtaḥ E105b  
 triśatyā vā kṛtir bhavet E31d  
 trisaptamityoś ca ciraṃ vicintya E11c  
 trisaptamityor vada me karaṇyor E14c  
 trairāśikam iti bīje Q11c  
 tryabhyastaṃ kṛtir ekayuk E101d  
 tryasrakṣetrasya yasya syāt E53a  
 tvaccetasi pravada tāta tatā latāvat E29d  
 tvattas tayor vada dhane mama kiṃpramāṇe E39d  
 tvatto bhavāmi hi sakhe dviguṇas tato 'nyaḥ E39b  
 dakṣo 'si gaṇite yadi E54d, E105d  
 dattaṃ daśakaśatena E42c  
 dadau daśaivaṃ nagaratrāye 'bhavat E47c  
 dantaiḥ siddhair gajair mitā vidvan E16b  
 dalena tulyaṃ hi tad eva kāryam 80d  
 daśapañcakaṇṭhantaram E51a  
 daśasu catasṛṇāṃ tithiṣu ca pañcānām 23b  
 daśāḍhyā vā daśonitāḥ E24b  
 daśāhataḥ syād vihr̥tas triṣaṣṭyā E27c  
 daśendrāhatarāśyaikyam E109c  
 dustaraḥ stokabuddhīnām 99a  
 dūtāhūta itas tato bhramati khe bhṛigo 'lisaṃkhyāṃ vada E41d

- dr̥ṣṭaḥ śākhāmrgaḥ śākhām E69c  
 dr̥ṣṭā girau dvādaśa te kiyantaḥ E68d  
 doḥkoṭīśravaṇān mama E74d  
 doḥkoṭīśravasāṃ vada E75b  
 doḥkoṭīśrutighātena E53c  
 doḥkoṭī tatra kā śrutih E73b  
 doḥkoṭyantaravargeṇa 62a  
 drammair avāpyate dramma- E79a  
 drutaṃ vadedam yadi bobudhīṣi E3d  
 dvayaṃ trayeṇa svam ṛṇena kiṃ syāt E2d  
 dvayor avyaktayor yathā 62d, 63d, 64d  
 dvayor dvayor yathāsanna- E71c  
 dvayor dvayoś cābhihatiṃ dvinighnīm 12b  
 dvātriṃśadguṇito vargaḥ E32a  
 dvādaśāṅgulaśāṅkubhā E70b  
 dvādaśādhyo 'thavā kṛtiḥ E31b  
 dvābhyāṃ tenonito rāśi- E67c  
 dvikatripañcapramitāḥ karaṇyaḥ E15a  
 dvikatripañcapramitāḥ karaṇyas E13a  
 dvikāgras trisamuddhṛtaḥ E82b  
 dvikāṣṭamityos tribhasaṅkhyayoś ca E11a  
 dviḡṇaṃ ṣoḍaśahīnaṃ E45c  
 dviḡṇena kayo rāśyor E109a  
 dviḡṇaṃ trihṛt khaṃ khahṛtaṃ trayam ca E5c  
 dviḡṇaghātasamānaṃ syād 63c  
 dviḡṇaṃ iṣṭaṃ kaniṣṭhaṃ 45c  
 dviḡṇasya ghanayogasya E90c  
 dviḡṇo ghātaḥ samanvitaḥ 62b  
 dvitīyapakṣe yadi rūpayuktaḥ 74b  
 dvitīyapakṣaṃ sati saṃbhavē tu 76a  
 dvitryaṣṭasaṃkhyā guṇakaḥ karaṇyo E12a  
 dvitryādikānāṃ samajātikānāṃ 8d  
 dvitryekamitaiḥ kṣayagaiḥ E9c  
 dvidhā mānaṃ kvacid bhavet Q6d<sup>7</sup>  
 dvidhā rūpaṃ vibhājitam 51b  
 dvidhā hrasvapadaṃ jyeṣṭhaṃ 51c  
 dvipañcāśadyutā kṛtiḥ E33b  
 dvividhotpadyate mitiḥ Q6d<sup>8</sup>

<sup>7</sup>Variant of 'dvidhotpadyate mitiḥ.'

<sup>8</sup>Cf. 'dvidhā mānaṃ kvacid bhavet.'

dviśatītulyāḥ karaṇyaś cet E20b  
 dviṣaṣṭipramito jātas E110c  
 dvyagram tryuddhṛtam antaram navahr̥tā pañcāgrā syād yutiḥ E83b  
 dvyagras trisamuddhṛtaḥ kaḥ syāt E80d  
 dvyūnaṣaṣṭivivarjitam E109d  
 dhanam dhanenarṇam ṛṇena nighnam E2c  
 dhanam dhanenarṇam ṛṇena bhaktam E3b  
 dhanabhājyavidhir bhavet Q0b  
 dhanabhājyodbhave tadvad 32c, Q1a  
 dhanarṇatāvyatyayam īpsitāyāś 16a  
 dhanarṇayoḥ saṃkalanām avaiṣi E1d  
 dhanarṇayor antaram eva yogaḥ 3b  
 dhanasya rūpatritayasya vargam E4a  
 dhanātmakānām adhanātmakānām E4c  
 dhanātmikām tām parikalpya sādhye 21b  
 dhanāvyaktayugmam virūpāṣṭakam ca E6b  
 dhanāvyaktayugmād ṛṇāvyaktaṣaṭkam E7c  
 dhanāvyaktavargatrayam satrirūpam E7a  
 dhātrī manusammitā sakhe bāhū E56b  
 dhīmatā takṣaṇe phalam 32f  
 na ced evam viśeṣo 'sti 94c  
 na tatra yojayet tām tu Q10c  
 na nirvahaś ced ghanavargavargeṣv 60c  
 na pāṭībījayor yataḥ 94d  
 na bījāni pṛthak pṛthak Q2b  
 na mūlam kṣayasyāsti tasyākṛtīvāt 4d  
 na yadi padaṃ rūpānām 89a  
 navabhiḥ saptabhiḥ kṣuṇṇaḥ E84a  
 navabhir barhiṇām trayam E78d  
 na hy udāharaṇānto 'sti 98c  
 nāgartavo yatra kṛtau karaṇyaḥ E19b  
 nikhilanavamabhāgāś cālinī bhṛṅgam ekam E61b  
 niyatādhārikāpi vā Q10b (aniyatā-)  
 niragrakam syādvada me guṇam tam E22c  
 niragrāḥ syuḥ sa ko guṇaḥ E25d  
 nirādhārā kriyā yatrā- Q10a  
 nirekaḥ kaḥ kṛtir bhavet E30b  
 nireko mūlado vada E30d  
 nirvahec ca yathā tathā 86d  
 niśi parimalalubdham padmamadhye niruddham E61c  
 nīlakavarṇās tripañcasaptadhanam E9b

naiva varṇātmakam bījam Q2a  
 pakṣasyaikasyoktavad vargamūlam 70b  
 pakṣe 'nyasminn ādyavarṇonmitiḥ syād 65c  
 pakṣau tadeṣṭena nihatyā kiñcit 59b  
 pañcakaśatadattadhanāt E42a  
 pañcakaśatena dattam E43c, E45a  
 pañcatriṃśadyutā vidvan E66d  
 pañcadaśadaśakarocchraya- E60a  
 pañcabhaktō viśudhyati E104b  
 pañcabhiḥ paṇaiḥ E88d  
 pañcabhiḥ sapta sārasāḥ E78b  
 pañcavarjitaśatadvayoddhṛtam E21c  
 pañcavibhaktō bhavec catuṣkāgraḥ E80b  
 pañcaśaṣṭisāhitās ca te 'thavā E26b  
 pañcāṃśo 'likulāt kadambam agamat tryaṃśaḥ śilīndhram taylor E41a  
 pañcāśat triyutāthavā Q14  
 pañcāśat triyutāthavā vada kiyat tad rāśiyugmaḥ pṛthak E108c  
 paṭha paṭha mativṛddhyai laghv idam prauḍhasiddhyai 102d  
 pade rūpaviśodhane 52b  
 parasparam bhājitayor yayor yaḥ 27a  
 pātre dānam manāg api 101b  
 pārthaḥ karṇavadhāya mārṅaṅagaṅam kruddho raṇe samdadhe E62a  
 purapraveśe daśado dviṣaṅguṅam E47a  
 pūrvam proktam vyaktam avyaktabījam 2a  
 pūrvavad vā prasādhyete 52a  
 pṛthak tadardhe karaṇīdvayam syān 20a  
 pṛthak taylor ye guṅakāralabdhī 36d  
 pṛthak pṛthaṅ me kathayāśu vidvan E13d  
 pṛthak pṛthaṅ me vada vājimaulyam E37d  
 pṛthak saikaḥ kṛtir bhavet E100b  
 pṛthaksthitiḥ syād yadi nāsti mūlam 14d  
 pṛthag dvitriṅguṅam triyuk E102b  
 pratiraṇati raṇantam brūhi kānte 'liṣaṅkhyām E61d  
 prājñe śāstram svayam yāti 101c  
 prāyaḥ praśnā no vināvyaktayuktyā 2b  
 phalam karṇena sammitam E53b  
 phalam guṅaḥ syād adharo hareṇa 29d  
 phalam bhūmiḥ vadāśu me E50d  
 phalasya vargam viśodhya pariśiṣṭam E42b, E43b  
 phalāny adho 'dhas tadadho niveśyaḥ 28c  
 phūtkāranādapratinādahrṣṭā E68c

bahukṣepaviśodhane 52d  
 bahudhā bījavittama E92d  
 bahuṣv api syāl layasrṣṭikāle 6c  
 bījaṃ ca vimalā matiḥ Q15b  
 bījaṃ matir vividhavarnaśahāyanī hi 73a  
 bījajña pratiratnajāni sumate maulyāni śīghraṃ vada E38d  
 bījajña vada tān mama E72d  
 bījāni yasmād ativistrtāni 96b  
 brahmāhvayaśrīdharapadmanābha- 96a  
 brūte daśārpayasi cen mama ṣaḍguṇo 'haṃ E39c  
 bhaktveṣṭeneṣṭatatphale 92f  
 bhavati kuṭṭavidher yutibhājyayoḥ 31a  
 bhavati na ced evam api khilaṃ tarhi 89d  
 bhavati yo yutibhājakayoḥ punaḥ 31c  
 bhavanti mūlaṃ tadā tad asat 25d  
 bhavetām ṛṇabhājyaḥ 32d, Q1b  
 bhavet ṣaḍviṃśater mitam E84d  
 bhāgalabdhasya no kalpyā 69c  
 bhāgādikaṃ rūpavad eva śeṣaṃ 9c  
 bhāgādhikā brūhi cayādigacchān E63d  
 bhāgāhāre labdhayas tāḥ syur atra 11d  
 bhājyaprakṣepabhājakān 46d  
 bhājyasthasyepsitā mitiḥ 69b  
 bhājyāc chedaḥ śudhyati pracyutaḥ san 11a  
 bhājyād dhatayutoddhrtāt 34d  
 bhājyās tayā bhājyagatāḥ karaṇyo 17a  
 bhājyo hāraḥ kṣepakaś cāpavartyaḥ 26a  
 bhāvanātas tatheṣṭataḥ 46b  
 bhāvitam pakṣato 'bhīṣṭāt 92a  
 bhāvitajña nigadyatām E107d  
 bhujakoṭivadhō yeṣu śatam E75c  
 bhujāt tryūnāt padaṃ vyekaṃ E74a  
 bhuvi nṛpamitahasteṣv aṅga lagnaṃ tadagraṃ E57c  
 bhūyaḥ kāryaḥ kuṭṭako 'trāntyavarnaṃ 68a  
 bhūr ajñātā ca catvāraḥ E50c  
 bhūr aṣṭadaśakaraṇī E51c  
 madhyamāharaṇe paṭuḥ E100d  
 mandaṃ mandaṃ calitam anilenāhatam hastayugme E58c  
 mandāvabodhavidhaye vibudhair nijādyaiḥ 73b  
 manye bījavidāṃ varam E55d  
 māṇikyāmalanīlamauktikamitiḥ Q8



māṅikyāmalanīlamauktikamitiḥ pañcāṣṭa sapta kramād E38a  
 māṅikyāṣṭakam indranīladaśakam muktāphalānām śataṃ E40a, E44a  
 mānaṃ kvāpi vyaktam evaṃ viditvā 58d  
 mānaṃ tasmin kurvatoddiṣṭam eva 56b  
 mānāni bhinnaṃ yadi mānam evam 67d  
 māseṣu saptadaśapañcasu tulyam āptaṃ E46c  
 mitho bhajet tau dṛḍhabhājyahārau 28a  
 muktveṣṭavarṇaṃ sudhiyā pareṣām 91a  
 mudgānām ca yadi trayodaśamitā etā vaṅik kākīṅiḥ E48b  
 mūḍhānām kalpanā yataḥ 81b  
 mūlaṃ kṣayo rūpavidhānahetoḥ 15d  
 mūlaṃ tac ca jyeṣṭhamūlaṃ vadanti 40d  
 mūlaṃ dadyāt kṣepakaṃ taṃ dhanarṇaṃ 40c  
 mūlaṃ navānām ca pṛthag vadāsu E4d  
 mūlaṃ sakalāntaraṃ gate varṣe E45b  
 mūlakaṛaṇyālpayā caturguṇayā 24b  
 mūlakaṛaṇyo bhavanti tāś cāpi 25b  
 mūladāḥ sarvamūlaikyād E72a  
 mūladā jāyate rāśiṃ E91c  
 mūladā ye dviṣaṃyutāḥ E71b  
 mūladā syād viyogas tu E94c  
 mūlado jāyate bīja- E89c  
 mūlado rūpaṣaṃyutaḥ E94d  
 mūlāny eṣām bhāvanā procyate 'taḥ 41d  
 mūle karaṇyāv anayor abhīṣṭā 21c  
 mūle te sto 'thavā kṣepaḥ 44c  
 mūle 'tha bahvī karaṇī tayor yā 20b  
 mūle vidadhyād asakṛt samatve 79d  
 maulyaṃ brūhi pṛthag yadiha gaṇite kalyāsi kalyāṇini E40d  
 yac caitatpadapañcakaṃ ca militaṃ syād vargamūlapradaṃ E97c  
 yat te karṇavibhūṣaṇe samadhanam kṛitaṃ tvadarthe mayā E40b  
 yat pañcakadvikacatuṣkaśatena dattaṃ E46a  
 yatra tatra vada kṣetre E74c  
 yatra tryasre kṣetre E56a  
 yatrādyasyeha bhavati tatrāpi 90b  
 yatrāvryaktaṃ sarūpaṃ hi 84a  
 yat syāt sālpadadhārdhato ghanapadaṃ yad vargayogāt padaṃ E97a  
 yathāgatau labdhiguṇau viśodhyau 30c  
 yathā bhaved bhāvitabhaṅga evaṃ 91c  
 yadagraikyam phalaikyādhyam E84c  
 yadagraikyam śataṃ dṛṣṭam E86c

yadagraikyam api triṃśad- E85c  
 yad ādyavittasya dalam dviyutaṃ E37a  
 yadi vetsi vada drutam E103d  
 yadi samabhuvī veṇur dvitripāṇipramāṇo E57a  
 yadaikyam yadghanaikyam vā E52c  
 yadguṇaṃ gaṇaka pañcaśaṣṭiyuk E21b  
 yadguṇas tatpadottaram Q7b  
 yadguṇā kṣayagaṣaṣṭir anvitā E23a  
 yady asti bīje paṭutābhimānaḥ E19d  
 yad yogāntarāyor dvikābhyadhikāyor vargāntarāt sāṣṭakāt E97b  
 yadyogo nakhasaṃguṇaḥ E107b  
 yadvargaḥ pañcabhiḥ kṣuṇṇas E105a  
 yayo rāśyoḥ prajāyate E95b  
 yayor ghāte ghano bhavet E54b  
 yayor vargayutir ghāta- E96a  
 yal labdham rāśinā yuktaṃ E87c  
 yas tripañcagūṇo rāśiḥ E100a  
 yasmāt tasmād vacmi bījakriyāṃ ca 2d  
 yasya vargakṛtiḥ pañca- E91a  
 yāvattāvat kalpyam avyaktarāśer 56a  
 yāvattāvat kālako nīlako 'nyo 7a  
 yāvattāvatkālaka- E9a  
 yāvattāvattrayam ṛṇam ṛṇaṃ kālakau nīlakaḥ svaṃ E10a  
 yāvattāvatpañcakaṃ vyekarūpaṃ E8a  
 yāvattāvad dvyādinighnaṃ hr̥taṃ vā 58b  
 yāvattāvadbhis tribhiḥ sadvirūpaiḥ E8b  
 yāvad vibhājye bhavatīha rūpaṃ 28b  
 yāsām apavartaḥ syād 24c  
 yā saiva bījagaṇitāhvayatām upetā 73d  
 yuktāḥ ke syuḥ samās trayāḥ E49b  
 yuktonaṃ vā kalpayed ātmabuddhyā 58c  
 yuktau pakṣau tato mūlam Q3d  
 yutā mūlapradā bhavet E96b  
 yutivargasya cāntaram 63b, 64b  
 yuto rāśyor vadhaḥ kayoḥ E110b  
 yuto vā pañcasaptatyā E31c  
 yutau pakṣayor etayoḥ kiṃ dhanarṇe E6c  
 yutau vargo 'ntare vargo E54a  
 yūthāt pañcāṃśakas tryūno E69a  
 yena chinnau bhājyahārau na tena 26c  
 yena pañca guṇitāḥ khasaṃyutāḥ E26a

- yena saṃgunitāḥ pañca E25a  
yeṣāṃ tān me pṛthag vada E76d  
yeṣāṃ vargaikyasaṃmitam E52d  
yair yair varṇaiḥ saṃguṇo yaiś ca rūpair 11c  
yogaṃ karaṇyor mahatīm prakalpya 13a  
yogaje takṣaṇāc chuddhe 32a  
yogāntarakṣepakabhajitād yad 82c  
yogāntare brūhi pṛthak karaṇyoḥ E11b  
yogāntare rūpavad etayoḥ sto 13c  
yogāntare staḥ kramaśas tayor vā 14c  
(yoge khaṃ kṣepasamaṃ) Q4a  
yoge yutiḥ syāt kṣayayoḥ svayor vā 3a  
yogo 'ntaraṃ teṣu samānajātyor 8a  
yogo doḥkoṭikarṇānām E76a  
yau rāśī kila yā ca rāśīnihatir yau rāśivargau tathā E108a, Q13a  
rahite vā tau rāśī E99c  
rāśīm tena samutthāpya 85a  
rāśīkṛtiḥ ṣaḍgunitā E66c  
rāśīkṣepād vadhakṣepo Q7a  
rāśīghanāḍhyaś ca kaḥ samā yasya E66b  
rāśīghātena tulyā syāt E106c, Q12c  
rāśīyogakṛtir miśrā E90a  
rāśīr dvādaśanighno E66a  
rāśīvargayuto hataḥ E67b  
rāśīs trimśadvibhājitaḥ E85b  
rāśīṃs tāṃś caturo vada E52b  
rāśī śīghram ānaya E95d  
rāśyantarakṛtes tulyaṃ 64c  
rāśyor yayoḥ kṛtiyuti- E99a  
rāśyor yogaghanena cet E90b  
rāśyor yogaviyogakau trisahitau vargau bhavetāṃ tayor E98a  
rūpakṛteḥ projjhya padaṃ 23c  
rūpakṛtes tā viśodhyāḥ syuḥ 24d  
rūpakṣepapadotthayā 53b  
rūpakṣepārthabhāvanā 50b  
rūpatrayaṃ rūpacatuṣṭayaṃ ca E1a  
rūpatrayaṃ svaṃ kṣayagaṃ ca khaṃ ca E5a  
rūpapadenānvitaḥ kalpyaḥ 88d  
rūpaśuddhau khiloddiṣṭaṃ 50c  
rūpāṇām navatir dviṣaṣṭir anayos tau tulyavittau tathā E38c  
rūpāṇi tāny evam ato 'pi bhūyaḥ 20c

rūpāṇi tu śodhanādisiddhāni 90d  
 rūpāṇy anyasyetarasmāc ca pakṣāt 57b  
 rūpāṣṭakam rūpacatuṣṭayena E3a  
 rūpenāḍhyā dviguṇitamitais te tu tair eva nighnāḥ E10b  
 rūpaiḥ pakṣadvayaṃ guṇayet Q3b  
 rūpaiḥ ṣaḍbhir varjitānām caturṇām E8e  
 rūpair daśabhir upetaṃ E18c  
 rūpair daśabhir upetāḥ E16c  
 rūpottarāṇi śeṣāṇy E81c  
 rūponaṃ vada taṃ rāśiṃ E67e  
 rūponā lambam ācakṣva E51d  
 laghvora ghāto yaḥ prakṛtyā vinighnaḥ 43b  
 laghvyā hṛtāyās tu padaṃ mahatyāḥ 14a  
 labdham kiṃ mūlam ācakṣva E45d  
 labdhāḥ karaṇyo yadi yogajāḥ syuḥ 17b  
 labdhiḥ śuddhau tu varjitā 33d  
 labdhvāvabodhakalikāṃ tata eva cakre 95c  
 liptāgram asmāc ca kalā lavāgram 38b  
 vajrābhyāsau jyeṣṭhalaghvos tadaikyam 42a  
 vada taṃ bījamadhye 'si E100c  
 vadham pracakṣvāśu vipaṅcarūpe E12c  
 vadhādu viyat khasya kham khena ghāte 5c  
 vadhe tu tadvargaghanādayaḥ syus 9a  
 vanāntarāle plavagāṣṭabhāgaḥ E68a  
 vanāgrakābhyām divasā ravīndvoḥ 38d (avamā-)  
 varga eva nigadyatām E34d  
 vargaḥ saikaḥ kṛtiḥ sakhe E28d  
 vargaḥ syād vada ced vetsi E35c  
 vargacchinne guṇe hrasvaṃ 53c  
 vargaprakṛtyāparapakṣamūlam 71a  
 vargaprakṛtyā viṣayo na cet syāt 71c  
 vargaprakṛtyā viṣayo yathā syāt 72c  
 vargaprakṛtyoktavad eva mūle 78b  
 vargayogasamaḥ sa syād 62c  
 vargayogasya yad rāśyor 63a  
 vargayogo guṇo na cet 50d  
 vargayogo yayora ghanāḥ E92b  
 vargavargo 'yutaṃ bhavet E67d  
 vargāder yo haras tena 87a  
 ⟨vargādaḥ kham khabhājito rāśiḥ/⟩ Q4b  
 vargādyam cet tulyāśuddhau kṛtāyām 70a

- vargāntaraṃ kayo rāśyoḥ E102a  
 vargāntarakṣepakataḥ padaṃ syāt 82d  
 vargitaḥ svapadenāḍhyaḥ E64c  
 vargitāḥ kṣepavarjitāḥ Q7d  
 vargito gahvaraṃ gataḥ E69b  
 varge karaṇītritaye 22c  
 varge karaṇyā yadi vā karaṇyos 19a  
 vargeṇa yogakaraṇī vihr̥tā viśudhyet 18a  
 vargeṇa vargaṃ guṇayed bhajec ca 13d  
 varge yatra karaṇyas E17a  
 varge yatra karaṇyo E16a  
 vargaiḥ ṣaḍbhiḥ samanvitaḥ E89b  
 vargaikyaṃ caturūnitaṃ raviyutaṃ vargāntaraṃ syāt kṛtiḥ E98b  
 vargaikyaṃ ca yayor ghaṇaḥ E55b  
 vargau syātāṃ vada kṣipraṃ E102c  
 varjitā ca yadi vā tribhis tataḥ E23b  
 varjitā vā tribhir bhaktā E25c  
 varṇaḥ pīto lohitaś caitadādyāḥ 7b  
 varṇasyaikasyonmitīnāṃ bahutve 65d  
 varṇāṅkāhatirūpaikyaṃ 92e  
 varṇāṅkau varṇayor māne 93c  
 viṃśatisaṃyutaṃ E75d  
 vikrīya ca punaḥ śeṣaṃ ekaikaṃ E88c  
 vidvaṃś cet supariśramo 'sti gaṇite kṣipraṃ tad ācakṣva me E59d  
 vidvan kuṭṭakavedikuṅjaraghaṭāsaṃghaṭṭasiṃho 'si cet E83d  
 vidhāya śeṣaṃ daśabhuk ca nirgame E47b  
 vinodārthaṃ mahīpateḥ E79d  
 viparyasya caikye bhavet kiṃ vadāśu E6d  
 vibhinnajātyoś ca pṛthaksthitiś ca 8b  
 viyutī caikena saṃyute vargau E99b  
 viyogamūlaṃ prathamam prakalpyam 82b  
 vilomakotthāpanato 'nyavarṇa- 67c  
 vivaraṃ tena vā bhajet 45b  
 vivarjitaṃ vā vihr̥taṃ triṣaṣṭyā E22b  
 viśodhayed rūpakṛteḥ padena 19c  
 viśleṣavargaṃ kṛtitaḥ padaṃ ca E14d  
 viśleṣasūtreṇa pṛthak ca kāryās 17c  
 viśleṣas triguṇo mṛgākṣi kuṭajaṃ dolāyamāno 'paraḥ E41b  
 vistāraṃ vastuśaktitaḥ 101d  
 vistāritā gaṇakatāmarasāṃśumadbhir 73c  
 vṛkṣād dhastaśatocchrayāc chatayuge vāpīm kapiḥ ko 'py agād E59a

veṅvor ajñātamadhyabhūmikayoḥ E60b  
 vetsi bījakriyāṃ yadi E67f  
 vyaktaṃ mānaṃ jāyate 'vyaktarāśeḥ 57d  
 vyaktapakṣasya cen mūlam Q6a  
 vyaktasya kṛtsnasya tad ekabījam 1c  
 vyaktasya pakṣasya padaṃ yadi syāt 61b  
 vyaktasya mūlasya samakriyaivam 60a  
 vyaktānāṃ kalpanā samīkaraṇam Q11b (avyaktānāṃ)  
 vyakte yad uktaṃ gaṇite tad atra 9d  
 vyaktoktakhaṇḍagaṇanāvidhir evam atra 10d  
 vyastaṃ ca saṃśodhya vadāśu śeṣam E2b  
 vyastaṃ syād ṛṇabhājake Q0d  
 vyastaṃ svarṇam kalpayitvā ca vidvan E8d  
 vyastaḥ prakṛtitaś cyute 48b  
 vyāptiṃ darśayituṃ kvacit 97d  
 vyekasya gacchasya dalam kilādir E63a  
 śataṃ hataṃ yena yutaṃ navatyā E22a  
 śatena śatam ānaya E79b  
 śalyam ṣaḍbhir atheṣubhis tribhir api chatraṃ dhvajam kārmukam E62c  
 śāstravistāravāridhiḥ 99b  
 śuddham bhāgam prayacchanti E24c  
 śuddhim eti guṇakaṃ vadāśu tam E21d  
 śuddhim eti tam ācakṣva E105c  
 śudhyati so 'pi dvirūpapadaguṇitaḥ 88b  
 śūnyasya vargam vada me padaṃ ca E5d  
 śūnye guṇake jāte Q5a  
 śeṣam tataḥ kṣepakam uktavac ca 79c  
 śeṣavidhinā na yadi tāḥ 25c  
 śeṣas tayoh syād apavartanam saḥ 27b  
 śeṣasya rūpāṇi yutunitāni 19d  
 śeṣāḥ karaṇyo yadi santi varge 20d  
 śeṣāt tyajed rūpapadam ḡhītvā 12c  
 śeṣāvyaktenoddhared rūpaśeṣam 57c  
 ṣatkapañcakayor iva E102d  
 ṣatpañcakatridvikasammitānāṃ E13c  
 ṣatpañcāsād vadhas tathā E76b  
 ṣatśatī saptabhiḥ kṣuṇṇā E76c  
 ṣaḍaṣṭaśatakāḥ E88a  
 ṣaḍbhaktaḥ pañcāgraḥ E80a  
 ṣaḍbhir ūno ghaṇaḥ kasya E104a  
 ṣaṣṭiḥ karaṇītrayaṃ kṛtau yatra E18b

- ṣaṣṭiśeṣās ca tān vada E49d  
 ṣaṣṭiś ca bhājyaḥ kudināni hāraḥ 37d  
 ṣaṣṭyāśītyā hṛtaḥ pṛthak E86b  
 saṃkṣiptaṃ gaṇitaṃ kila 55b  
 saṃgasnehavaśena te nijadhanād dattvaikam ekaṃ mitho E44c  
 saṃguṇya drāg brūhi guṇyaṃ guṇaṃ vā E8c  
 saṃyutir dviyutā tayoh E106b, Q12b  
 saṃvargito valgati jātarāgaḥ E68b  
 saṃśodhyamānaṃ svam ṛnatvam eti 3c  
 saṃśliṣṭasaṃjñāḥ sphuṭakuṭṭako 'sau 39d  
 sakalagaṇitasāraṃ sopapattiprakāram 102b  
 sa ca bhaved apavartanasamguṇaḥ 31d  
 sadyuktiyuktaṃ laghu śiṣyatuṣṭyai 96d  
 sadvajrāṇi ca pañca ratnavañijāṃ yeṣāṃ caturṇāṃ dhanam E44b  
 saptadaśarūpayuktās E20c  
 saptabhakto viśudhyati E103b  
 saptabhir nava haṃsās ca E78c  
 saptāvaśeṣo 'tha sa eva rāśiḥ E27b  
 saptāṣṭagaṇayor yutiḥ E94b  
 sabhāvite varṇakṛtī tu yatra 80a  
 samaṃ yasya ca tad vada E53d  
 samapavartitayor api vā guṇaḥ 31b  
 samāso 'pi yayor vargas tau E95c  
 samīkṛtacchedagame tu tābhyas 66a  
 sarūpake varṇakṛtī tu yatra 79a  
 sarūpam avyaktam arūpakaṃ vā 82a  
 sarūpaś cāśu tau vada E96d  
 sarūpasyānyavarṇasya 84c  
 sarūpāṣṭakaṃ projjhya śeṣaṃ vadāśu E7d  
 sarūpeṇānyavarṇena 85c  
 sarūpo jāyate ghaṇaḥ E101b  
 sarvatra bhavet kriyāhetuḥ Q11d  
 sarvatraivaṃ vipaścidbhiḥ Q5d  
 sarvarāśihates tulyo E107c  
 sarve tulyadhanās ca te vada sapady aśvādimaulyāni me E77d  
 saviśvarūpā vada tatpadaṃ te E19c  
 sasūtroddeśake mitiḥ 97b  
 sahitā rahitāḥ kati syus taiḥ E9d  
 sā tulyā gaṇakocyatām E90d  
 sādhyāny ebhyo bhāvanābhir bahūni 41c  
 sādhye tadā jyēṣṭhakaniṣṭhamūle 74d

sārdham taṇḍulamānakatrayam aho drammeṇa mānāṣṭakam E48a  
 sālpam ghātadalam ghanah padayutis teṣām dviyuktā kṛtis E98c  
 sāvyaktarūpo yadi varṇavargas 77c  
 sūtrayuter lambamānam ācakṣva E60d  
 saikam nirekam svahatam laghughnam 14b  
 stokam uktam idam yataḥ 98d  
 spaṣṭam paṭīyān yadi kuṭṭake 'si E22d  
 syāt trayodaśahr̥tā niragrakā E23c  
 syād ādyabījakriyayeṣṭasiddhiḥ 91d  
 syād rūpavarṇābhīhatau tu varṇo 8c  
 syān mūladā yadi kṛtiprakṛtir nitāntam E29c  
 syuḥ pañcasaptanavabhiḥ E81a  
 syur labdhayaś ced viṣamās tadānīm 30b  
 syus trayodaśahr̥tā niragrakās E26c  
 svataḥṣaṇāc cheṣamitau tu tau staḥ 30d  
 svatvam kṣayas tadyutir uktavac ca 3d  
 svapadābhyām khabhaktaś ca E65c  
 svabuddhyaiva pade jñeye 52c  
 svam avyaktam ekaṁ sakhe saikarūpam E6a  
 svayam evopagacchati 100d  
 svayor asvayoh svam vadhaḥ svarṇaghāte 4a  
 svarṇam kṣayasvam ca pṛthak pṛthak ced E1c  
 svasvarṇagā vyastadhanarṇagā vā E15b  
 svahārataṣṭe bhavatas tayos te 37b  
 svārdhapañcāmśanavamair E49a  
 sveṣu sveṣu sthānakeṣu krameṇa 11b  
 svordhve hate 'ntyena yute tadantyaṁ 29a  
 hatvā kṣiptvā ca padaṁ 90a  
 harataṣṭe dhanakṣepe 33a  
 harabhaktā yasya kṛtiḥ 88a  
 hr̥tam ekādaśāgrakam E85d  
 hrasvam laghvor āhatiś ca prakṛtyā 42b  
 hrasvam bhavet prakṛtivarṇamitiḥ sudhībhir 75c  
 hrasvam vajrābhyāsayor antaram vā 43a  
 hrasvajyeṣṭhakṣepakān nyasya teṣām 41a  
 hrasvajyeṣṭhapadakṣepān 46c  
 hrasvajyeṣṭhe kramāt pade 54d



### III.6 Index to Words

In this index, compounds are listed under each member. The word order in a compound is indicated by hyphens. Thus, a compound ‘a-b’ is listed twice: item a with sub-item -b and item b with sub-item a-; a compound ‘a-b-c’ is listed three times: item a with sub-item -b and sub-sub-item -c (item a with sub-item -bc if the compound ‘a-b’ does not occur), item b with sub-item a- and sub-sub-item -c (or item b with sub-item -c and sub-sub-item a- if b is more strongly connected with c than with a), and item c with sub-item b- and sub-sub-item a- (or item c with sub-item ab- if the combination ‘b-c’ exclusively makes a compound with a in the BG). When the compound has a fourth member (d), it is coupled with a or c as the case might be or, otherwise, it is indicated immediately after the reference number (n): ‘n(d-)’ for ‘d-a-b-c’ and ‘n(-d)’ for ‘a-b-c-d.’ It should be noted that a concept in Sanskrit texts is sometimes expressed by a compound but sometimes by the separated members of that compound. For example, ‘the sum of two squares’ can be expressed either as *varga-yogaḥ* or as *vargayor yogaḥ*. In the former case, the compound is listed under both *varga* and *yoga*, while in the latter case simply each word is indexed. Those compounds which mean arithmetical operations involving particular numbers such as *rūpa-yuta* (‘increased by unity’), *dvy-ūna* (‘decreased by two’), *tri-guṇita* (‘multiplied by three’), *catur-hṛta* (‘divided by four’), *pañca-agraka* (‘having the remainder five’), etc. are excluded: in these cases, each member is listed individually. So also are simple *dvandva* compounds. Conjugated forms of verbs are listed under their root forms. For the order of the Indian letters see Appendix 3.

<b>a</b>	-tva 4d
aṃśa E40p2, E49c, E49p	akṣara 68p1
-yugala E48c	ādya- E1p
aṣṭa- E68p	varṇa- 68p4
cheda-	akṣi
-viparyāsa E40p2	mṛga- E41b
tri- E37p3, E41a, E70p1	akhila 51a, E86p
-dvaya E100p2(ṛṇa-)	agra 39c, E27d, E27p1, E57c, E57p, E80a-
pañca- E41a, E49a	d, E80p1–p2, E81p, E82a–c, E82p,
aṃśaka	E83a–c, E83p, E84c, E84p, 90p2
pañca- E69a, E69p	-aikya 39c, E27p1, E84c, E85c, E85p,
aṃśu	E86c
-mat 73c	-tas E48d
akṛti	kamalakalikā- E58b

- nir- E25d  
 mūla-  
 -ga E60c  
 lava- 38b  
 liptā- 38b  
 -agraka E85d  
 adhimāsāvama- 38d  
 nir- E22c, E23c, E26c  
 aṅka 68p3, 73p1, E94p, E95p1, 90p1–p2,  
 93p3–p4  
 kālaka- 93p1, 93p5-fig  
 bhāvita- 92c, 93p1, E109p, E110p2–p3  
 yāvattāvad- 93p1, 93p3–p4  
 yāvad- 93p5-fig  
 varṇa- 93c, 93p1–p2, 93p4–p5, E109p,  
 E110p1–p3  
 -āhati 92e, 93p2, E109p, E110p1–p3  
 vyakta- 68p4  
 aṅkita  
 nāma- E44p  
 aṅga E57c, E77a  
 aṅgula E70c, E70p1  
 dvādaśa-  
 -śaṅku E70b(-bhā)  
 acyuta 6d  
 ajñāta E37p1, E50c, E60b, Q15c  
 atas 20c, E15p2, 25p, E16p1, E17p, E18p,  
 E23p2, E25p1, 41d, E28p2–p4,  
 48d, E29p1–p3, E29p5–p7, E30p1,  
 E30p3, E32p, 55c, E37p2, E38p2,  
 E39p, E41p, E42p1–p3, E43p1,  
 E44p, E45p, E49p, E50p, E55p2,  
 61p1, E67p, E70p1, E72p2, E73p1,  
 62p, E74p, E75p, 68p1, 68p3, 68p5,  
 E79p, E80p1, E81p, E86p, E87p,  
 73p1–p2, E97p1, E99p3, E102p,  
 E107p, E108p1, 93p3–p5, E110p1,  
 Q15d  
 atiparicita E72p3  
 ativistrta 96b  
 atra E1p, 9d, 10d, 11d, E12p1–p2, E12p4–p5,  
 18p1–p3, E14abp1, E14cdp, E15p1,  
 E16p1, E17p, E18p, E19p, E21p,  
 E22p1–p2, E22p4, E23p1, E24p,  
 E25p1, E25p3, 37abp, E27p1, 43d,  
 E28p1–p2, E29p1, E29p3, E30p1,  
 E30p3, E31p, E33p1, E34p, E35p,  
 E37p1–p3, E38p1, E39p, E40p1–p2,  
 E41p, E42p1, E42p3, E43p1, E44p,  
 E45p, E46p, E47p, E48p, E49p,  
 E50p, E51p, E52p1, E53p1, E54p,  
 E55p1, E56p, E57p, E58p0, E58p,  
 E59p, E60p1–p2, 59p0, Q3p0, E61p,  
 E62p, E63p, E64p1–p3, E65p1,  
 E66p, E67p, E68p, E69p, E70p1,  
 Q6p0, E72p1–p2, Q7p0, E73p1–  
 p2, E74p, 63p, 64p, E75p, E76p1,  
 68a, 68p1, 68p5–p6, E77p, E79p,  
 E80p1–p2, E81p, E82p, E83p, E84p,  
 E85p, 69p0, 69a, E86p, E87p,  
 E88p0, E88p1–p2, 74c, 75d, E89p,  
 E90p, E91p, E92p, 78p, E93p,  
 E94p, E95p1, E96p, E97p1, 81d,  
 E98p1–p2, E99p1, E99p3, E100p1–  
 p2, E101p, E102p, E103p, E104p,  
 E105p1, E106p, E107p, E108p1,  
 93p3, E109p, E110p1–p4, 97a  
 atha 7p0, E9p1, E10d, 13p1, E12d, 16p0, 19b,  
 20b, 21p0, E15p2–p3, 25p, E16p2–  
 p3, E19p, E20p0, 26p0, 34a, 35a,  
 E21p, E22p2–p4, E25p2–p3, E26b,  
 36cdp0, 37abp, 37c, 39p0, E27b,  
 40p1, 44c, E28p3, 46cdp0, 47d,  
 50cdp0, E30p1–p2, E31b, 52cdp0,  
 E32p, 54p0, E34p0, 56p0, 58p4,  
 E37p1–p3, E38p2, E39p, E42p0,  
 E42p2, E43p2, E49p, E52p2, E53p2,  
 E55p3, E59b, E60p2–p3, 59p1,  
 59p0, 61p2–p3, E62c, E64p2–p3,  
 E73p2, E76p1, 65p1, 68p1, 68p4–  
 p5, E77p, E79p, E80p2, E81p, E83p,  
 E86p, 70p1, 72a, 73p2–p3, E89p,

- E90p, 76p0, 79p0, 80p1, E95p2,  
E97p0, E97p3, 82p0, E98p2, E99p2,  
E99p5, E100p2, E101p0, E102p,  
E103c, 88p0, 90p3, E105p2, 91p1,  
E106p, E108c, E108p1–p2, 92p0,  
Q12p0, 93p4, Q13p0, Q14a, 99c
- adas 15b, 39d, E96p, E105p1
- adhana  
-ātmaka E4c
- adhara 29d, E29p1  
-khaṇḍa E57p
- adhas 28c, E21p, E25p1, 41b, 93p4  
-tana 93p3
- adhika 20p1–p2, E15p1, 58p2, E49p, E63d,  
E63p, E67p, E76p1, E81p, 69a,  
E88p1, E97p2, 83a, E103p, 90p3,  
E104p, E105p2, 93p4–p5  
-tara 93p3  
-pakṣa 58p2
- adhimāsa  
-avamāgraka 38c  
-śeṣa 38p2  
kalpa- 38p2  
gata- 38p2
- adhiṣṭhita 1b
- adhyāya  
kuṭṭaka- E27p2  
gola- (38p1)  
praśna- 38p1  
bījagaṇita- 102p
- ananta E5cdp1, 6d  
-mūla E28p2  
-rāśi E5cdp1 (ananto rāśiḥ)
- analpa Q2d
- aniyata  
-ādhāra E88p2  
-kriyā E88p2  
-ādhārika Q10b
- aniyama E16p2
- anila E58c
- anukta E15p3
- anupapanna  
-tva E69p, E70p1, E76p1
- anupāta E43p1, E60p2, E79p, E88p1
- anuṣṭubh 97a
- aneka  
-dhā E28p3, E38p2, E74p, 68p2, E79p,  
E96p, E97p2, E99p5  
-padānayana 54p0  
-varṇa E9p1, E9p2, E10p3, E10p6–p7,  
E105p4  
-madhyamāharaṇabheda 70p1  
-samikaraṇa 58p1, 65p1, 68p1, E88p3  
-vidha E82p
- anta 28d  
udāharaṇa- 98c  
siddha- 73p3  
-śiromaṇi 102p
- antar 93p5  
-kṣetraphala 93p4(tad-)  
-gata (38p1)  
-bhūtatva E85p  
-vartin 80p2, 93p3, 93p5  
kṣetra- 93p3  
-gata 93p4  
kṣetramūla-  
-bhūta 93p4
- antara 3b, E2abp1, 8a, 13c, 14c, E11b, E11p1,  
E12p2, 18p2, 43a, E28p3–p4, E51a,  
E51p, E54a, E54p, E57p, E74b,  
E74p, 63b, 63p, 64b–c, 64p, E75p,  
E76p1, E83b, E83p, E92a, E92p,  
E94p, E97b, E97p2, E98p1, E99p3,  
E102p  
-varga E72p1  
kalā- E42p2–p3, E45p  
sa- E45b, E46p  
koṭikarṇa- E58p0, E74b  
koṭibhuja- E73p2  
doḥkoṭy-  
-varga 62a  
pakṣa- E28p4

- taruvāpy- E59p  
 rāśy- E99p4  
 yoga-  
 -kṣepaka 82c  
 -ghāta E99p3  
 vaṃśa- E60p3  
 varga- E74p, E97b, E97p2, E98b, E98p2,  
 E99p3–p4, E102a, E102p  
 -kṣepakatas 82d  
 -mūla E98p1, E98p2  
 -yoga E99p3  
 veṅv- E60p1  
 samāsa-  
 -bhāvanā E28p4  
 antarāla E68a  
 antarita 50cdp0  
 antya E14abp1, 29a, 68p5, E98p1, 86b  
 -unmiti 66c, 68p3, E77p  
 -varṇa 68a  
 -māna 68p4  
 anya 7a, E7abp0, E7cdp0, E15p1, E17p, 41b,  
 E30p3, 57b, 58p3–p4, E36b, E37p2,  
 E39b, E49c, E49p, E50p, E51p,  
 E53p1–p2, E56c, E56p, E73p2,  
 64p0, 65b–c, 67a, 68p2, E86p,  
 76p0, 77cdp0, E93d, 79p0, 80p3–p4,  
 E97p3, E99p4–p5, 85p, 87p0, 90p3,  
 E105p3, 93p3–p4, E110p4  
 -ukta E42p0  
 -kṣetra 93p5  
 -tara E38b  
 -tas E37c, 65b, 92c, 93p1  
 -pakṣa 57a, 58p2, E37p1, 61p1, E66p,  
 E67p, Q6b, 65a, 73p1–p2, 78a, 78p,  
 E93p, E100p1, 87p  
 -māna 72a  
 -rāśi E97p3  
 -varṇa 68p2, 71d, 77d, 84c, 85c, 85p, 88c,  
 90p1–p2, 93p4  
 -unmiti 66b, 68p2  
 -kalpanā 88p0  
 -māna 67c, 68p3–p4  
 -varga 73p2, 78p, 87e, 87p  
 anyatra E110p3  
 anyathā 16p0, 23d, E18p, E19p, E23p2,  
 E42p2, E73p2, 62p, E86p, E87p,  
 E99p5, 93p5  
 anyonya E44p  
 anvita E23a, E48c, E71d, 88d, 90p1–p3  
 apagama E51p  
 apa-√nī  
 apanīya E39p  
 apanīta 64p, 68p6, 93p3  
 apara E41b, 68p6, 72a, E98p3, 85b  
 -pakṣamūla 71a  
 apavarta 24c, 25a, E17p, 27c, 76d, E91p, E92p  
 apavartana E18p, 27b, 31d, E22p2–p4  
 avyakta- E55p3  
 apavartita E21p, E22p2–p3  
 apavartya 26a  
 apa-√vṛt  
 apavartya E22p4, E30p3, E42p1, E52p1–  
 p2, E53p1–p2, E54p, E55p3, E63p,  
 E76p1, E90p, 76b, E91p, E92p,  
 E95p2, 93p1  
 apa-√hā  
 apahāya 91p  
 apahr̥ta E80p2  
 apās (apa-√as)  
 apāsya 20p1–p3, E15p1–p2, E16p1–p2,  
 E17p, E19p, E28p2, E50p, E51p,  
 E81p, E84p, E85p, E87p, E88p1,  
 93p1  
 api E1p, 4b, 6b–c, E12p5, 18p3, E14abp1,  
 20c, 20p1, E15p2–p3, 25b, E16p3,  
 E17p, E19p, E20p0, 31b, E22p2,  
 E23p1, E25p3, 43d, E28p4, E30p3,  
 56d, 58a, 58p2, E37p1–p2, E42p0,  
 E42p1, E46d, E49p, E53p1–p2,  
 E57p, E58p, E60p3, 61p1, E62c,  
 E65p1, E69p, E73p1, 62p, 67a,  
 68p6, E77p, E80p2, E81d, E82p,

- E85c, E85p, Q10b, E88p1–p2,  
73p2–p3, E95c, E97p1, E98p1,  
E99p3, 88b, 89d, 90b, 90p1–p3,  
E104p, E105p1, E105p3, 93p1,  
93p4, E110p3, 99d, 101b  
kim- 26b, E59a, E97p0, E99p3  
kutra- E60p3  
kva- 23d, 58d, E58a, E76p2, E93b  
abhāva  
kṣepa- 35a, E26p  
prayojana- E51p  
phalaviśeṣa- E50p  
mūla- E11p1, E19p, E103p, E110p2  
avyaktapakṣa- 61p2  
karaṇīgata- E16p1  
abhinna 49d, E30p3, E80p1, E81p, E82p,  
E83p, E86p, E92c, E99p3, 87d, 87p,  
E103p, E105p1, E108d, E108p1–p2  
-kālakonmāna E80p2  
abhimāna  
paṭutā- E19d  
abhihati 8c, 12b, E63c  
abhīpsita 17d, 37a  
abhīṣṭa 21c, E14cdp, 37abp, 92a  
abhyadhika E97b  
abhyasta E101a, E101d, E101p  
abhyāsa 42c–d, E28p1, E104d  
vajra- 42a, 43a, E28p1, E28p3  
amala Q11a  
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sarva 58p2, E47p, E49p, E72a, E72p2, E73p2, E77d, E88p1, E97p1, E107c	prauḍha- 102d
-karaṇītulya E16p2	su-
-doṣa 102c	-dhī 21d, E56p, 72d, 75c, E105p3, 91a, 99d
-dhana E46p, E38p1	-pariśrama E59d
sarvatra E25p1, 37abp, E30p3, E40p1, E55p2, Q5d, E74p, E76p2, Q11d, E93p, 93p3	-buddhi Q15c
salila E58a	-mati E38d
saha E28p1, E28p3	sūtra 19p0, 21p0, 36cdp0, E60p3, 59p0, 63p0, 65p0, 69p0, 70p0, 74p0, 76p0, 77cdp0, 79p0, 82p0, 84p0, 88p0, 91p0, 92p0
sahasra 97a	-arthaviṣaya 97c
-dhā 81a	-avatāra 68p1
sahāya 73p3	-uddeśaka
sahāyana	sa- 97b
vividhavarṇa- 73a	-yuti E60d
sahita E1b, 10b, E9d, E26b, E65a, E98a, E98p1	-saṃpāta E60p1
sāṃkhya 1b	ityādi- E106p
√sādh	karaṇa- 3abp0, 3cdp0, 4abp0, 4cdp0, 5abp0, 5cdp0, 8abp0, 8cdp0, 11p0, 13p0, 39p0, 40p0, 46cdp0, 50cdp0, 52cdp0, 54p0, 62p0, 64p0, 87p0
sādhyate 15b	parokta- E23p2
sādhanīya 56c	pūrva-
sādhita E24p	-ukta 87p
sādhya 21b, E17p, E23p2, 38p1, 41c, 61c, 61p3, 67b, 68p4, E83p, E88p1, 73p1–p2, 74d, 78p, 80p1, 80p3	mūla- 73p3
sāmya 68p2, E80p2, E93p, 85p, E100p1, E103p, E104p, E110p2, E110p4	viśeṣa- 15p0
-karaṇa E48p, E77p, E77p, E80p1, E81p	viśeṣa- 17c, 18p0
sāra 96c	śrīdharācārya- Q3p0
sakalagaṇita-102b	sūrya E19a
sārasa E78b	sṛṣṭi
sārtha E48d	-kāla 6c
siṃha E83d	stoka 98d
√sidh	-buddhi 99a
sidhyati E43p2	-stha
siddha 12p1, E16b, E23p2, E110p4	koṇa- 93p5
-anta 73p3	bahiḥ- 93p5
-śiromaṇi 102p	dvi- (dviṣṭha) E33p1
śodhanādi- 90d, 90p1, E105p1	bhājya- 69b
siddhi	sthānaka 11b
iṣṭa- 91d	sthāpya E14abp1, E23p2, E105p1

- sthiti  
     pr̥thak- 8b, 14d, E11p1  
 sthira  
     -kuṭṭaka 36cdp0  
 sneha  
     saṃga-  
     -vaśa E44c  
 spaṣṭa 25p, E22d, E50p  
     -ārtha 77abp  
 sphuṭa  
     -kuṭṭaka 39d  
 sva 3a, E1c, 3c, E2a, 4a, E2d, E3c, 4c, E5a,  
     E6a, E8d, 11b, 11p1, E10a, 14b,  
     E12p4, 29a, 30d, 36a, E21p, E22p2,  
     E22p4–p5, E23p1–p2, E25p1–p2,  
     37b, 37abp, E29p1, E38p1, E49a,  
     E49p, E50p, E51p, E56p, E63c,  
     E63p, E64c, E64p1–p3, E65a, E65c,  
     E65p1, 68p3, 68p6, E77p, E79p,  
     E80p1–p2, E81p, E82p, E86p, E90p,  
     E92p, 83c, E100p1, 93b, 93p1–p3  
     -tas E37p1, E80p2, E100p2  
     -tva 3d  
     -buddhi 52c, E43p2, 60d, E67p, 80p1  
     -rūpa 63p  
     -svarṇaga E15b  
 svayam E55p1, 100d, 101c
- h**
- ha (= haritaka) E80p1–p2, E81p, E82p, E83p  
 hamsa E78c  
 hata 10b, 14b, 29a, 34d, E21p, E22a, E24a,  
     E25p3, E28a, E67b, E72p1, 80p1,  
     E101p, 90p1–p2  
 hati E107c  
 √han  
     hatvā 90a, 90p1, E105p1  
 haya E62b  
 hara 11p1, 16c–d, 29d, 35b, 35d, 36a, E22p2,  
     E25p1–p3, 38p3, 39a, E29p1,  
     E40p2, E64p1–p3, E65p1, E80p1–  
     p2, E81p, E82p, E83p, E84p, E85p,  
     E86p, E87p, E88p1, 87a, 87p,  
     E103p, 88a, 89b, 90c, 90p1–p3,  
     E104p, E105p1  
     -taṣṭa 33a, E25p2, E29p1, E29p3, E29p5,  
     E30p3, 68p5, 90p1–p2  
 eka-  
     -tva E84p  
 kha- E5cdp1, 6a, Q4c  
     -tva E64p1–p3  
 haraṇa 11p1, 68p3, E80p1  
 haritaka 68p1, E80p1, E81p, E82p, E83p  
     -māna E80p1  
 hasta E57c, E58c, E58p, E59a  
 √hā  
     hitvā E98d  
 hā (= hāra) E21p, E22p1–p4, E23p1, E24p,  
     E25p1–p3, E26p, E27p1, E29p1–p3,  
     E29p5, E30p3  
 hāra 26a, 26c, 27d, E22p3–p4, E25p1, 37d,  
     38p1–p2, E64p1, Q5b  
     -taṣṭa 37b, 37abp, 89b  
     -rūpa 90p3  
 kha- 5d  
 dṛḍhabhājya- 28a, E21p, 37abp  
 bhāga- 4abp0, 4b, E3p2, 11p0, 11p1,  
     E12p4, 34a, E23p1, E25p3, E81p,  
     E86p  
 hi E39b, E48d, E69p, E74p, E75p, E81p,  
     E82d, 73a, 73p3, 80d, 83c, 84a, 97a,  
     98c  
 hīna E37p2, E45c, E45p  
 huta  
     -aśana E17b  
 √hṛ  
     hṛtvā E29p3  
     -hṛt E5c  
 hṛta E3p1, E5c, 11p1, 14a, 18p1–p3, 35d,  
     E23c, E26c, 44a, E28p2–p3, 48a,  
     E29p2, E29p5–p6, E30p1–p2, 54c,

E33p1, 58b, E51p, E60p3, E64p1–  
p3, E81b, E82a, E82p, E83b–c,  
E83p, E84b, E85d, E86b, E86p,  
E87p, E88p1, 80p1, E96p, E102p,  
93p2, E109p, E110p2

hr̥ṣṭa E68c

hetu

karaṇītva- 15b

kriyā- Q11d

rūpavidhāna- 15d

hrasva 40a, 41a, 42b, 43a, E28p1, E28p3,  
48c, E29p1, E31p, 53c, E32p, 54d,  
E33p1–p2, 75c, E89p, 80p1, E94p,  
E99p1

-jyeṣṭhapada 46c, E30p3–p4

-pada 51c

hriyamāṇa E40p2, E80p1

### III.7 Concordance of Verse Numbers

For the abbreviations, A, M, G, T, P, J, F, and C and the notation, see I.1, I.2, and I.3.

Addition to the notation:

n.n. = the verse occurs but no serial number is given to it.

The following abbreviations are used for the names of the meters.

Anu = Anuṣṭubh

Āry = Āryā

Indr = Indravajrā

Udg = Udgīti

Upag = Upagīti

Upaj = Upajātikā

Gīt = Gīti

Drut = Drutavilambita

Bhuj = Bhujāṅgaprayāta

Mand = Mandākrāntā

Māl = Mālinī

Rath = Rathoddhatā

Vaṃś = Vaṃśastha(-vila)

Vas = Vasantatilakā

Śār = Śārdūlavikrīḍita (also called Siṃhoddhatā or Siṃhonnatā)

Śāl = Śālinī

Siṃh = Siṃhoddhatā/Siṃhonnatā

BG	Meter	A	M	G	T	P	J	F	C	Notes
<b>1. dhanarṇa-ṣaḍvidha</b>										
1	Upaj	1	1	1	1	1	1	1	1	
2	Śāl	2	2	2	2	2	2	2	2	
3ab	Upaj 1/2	(1)	(1)	(3)	(3)	3	3ab	3	3	
E1	Upaj	1	1	1	1	4	3cd-4ab	4	4	
E1p'	prose			n.n.	n.n.	5	(n.n.)	(n.n.)		Opening passage of E1p cited by Kṛṣṇa (in TP) and by Sūryadāsa (fragmentarily in JF).
E1p''	prose			n.n.	n.n.	6	∅	∅		Last sentence of E1p cited by Kṛṣṇa (in TP).
3cd	Upaj 1/2	1	1	3	3	7	4cd	5	5	
E2ab	Upaj 1/2	(2)	(1)	(2)	(2)	8	5ab	6	6	
4a	Bhuj 1/4	(2)	(2)	(4)	(4)	9	5c	7	7	
E2cd	Upaj 1/2	2	1	2	2	10	6ab	8	8	
4b	Bhuj 1/4	(2)	(2)	(4)	(4)	11	5d	7	7	Displayed together with 4a in AMJF.
E3	Upaj	3	1	3	3	12	6cd-7ab	9	9	
4cd	Bhuj 1/2	2	2	4	4	13	7cd	10	10	
E4ab	Upaj 1/2	(4)	(1)	4	4	14	8ab	11ab	11	
E4cd	Upaj 1/2	4	(1)	4	4	15	8cd	11cd	11	
<b>2. kha-ṣaḍvidha</b>										
5ab	Bhuj 1/2	(3)	(3)	(5)	(5)	16	9ab	12	12	
E5ab	Indr 1/2	(5)	(1)	(5)	(5)	17	9cd	13	13	
5cd	Bhuj 1/2	3	3	5	5	18	10ab	14	14	
E5cd	Indr 1/2	5	(1)	5	5	19	10cd	15	15	
6	Upaj	4	4	6	6	20	11	16	16	Numbered as an example in T and as a rule in AMG.



BG	Meter	A	M	G	T	P	J	F	C	Notes
<b>3. avyakta-ṣaḍvidha</b>										
<b>3.1. avyakta-ṣaḍvidha</b>										
7	Śāl	5	5	7	6	21	12	17	17	17
8ab	Upaj 1/2	(6)	(6)	(8)	(7)	22	13ab	18	18	18
E6	Bhuj	6	1	7	7	23	13cd-14ab	19	19	19
E7ab	Bhuj 1/2	(7)	(2)	(8)	8	24	14cd	20	20	20
E7cd	Bhuj 1/2	7	2	8	8	25	15ab	20	20	20
8cd	Upaj 1/2	6	6	8	7	26	15cd	21	21	21
9	Upaj	7	7	9	8	26	16	21	21	21
10	Vas	8	8	10	9	27	17	22-23	22	22
E8	Śāl	8	1	9	9	28	18	24	23	23
11	Śāl	9	9	11	10	29	19	25	24	24
E8ef	Śāl 1/2	(9)	(1)	9	n.n.	30	20ab	26	25	25
12	Upaj	10	10	12	11	31	20cd-21ab	27	26	26
<b>3.2. anekavarṇa-ṣaḍvidha</b>										
E9	Āry	10½	1	10	10	32	21cd-22ab	28	27	27
E10	Mand	11	1	11	11	33	22cd-23ab	29	28	28
<b>4. karaṇī-ṣaḍvidha</b>										
13	Indr	11	11	13	12	34	23cd-24ab	30	29	29
14	Upaj	12	(12)	14	13	34	24cd-25ab	31	30	30
E11	Upaj	12	(1)	12	12	35	25cd-26ab	32	31	31
E12	Upaj	13	(2)	13	13	36	26cd-27ab	33	32	32
15	Upaj	13	13	15	14	37	27cd-28ab	34	33	33

BG	Meter	A	M	G	T	P	J	F	C	Notes
16	Upaj	14	14	16	15	38	28cd-29ab	35	34	
17	Upaj	15	15	17	16	38	29cd-30ab	36	35	
18	Vas	16	16	18	17	39	30cd-31ab	37	36	
E13	Upaj	14	(1)	14	18	40	31cd-32ab	38	37	
E14ab	Upaj 1/2	14½	(2)	(15)	n.n.	40	32cd	38	38	
19	Upaj	17	17	19	19	41	33	39	39	
20	Upaj	18	18	20	20	41	34	40	40	
21	Upaj	19	19	21	21	42	35	41	41	
E14cd	Upaj 1/2	15	(1)	15	22	43	36ab	42	42	
E15	Upaj	16	(2)	16	23	43	36cd-37ab	43	43	
22	Gīt	20	20	22	21	44	37cd-38ab	44	44	
23	Gīt	21	21	23	22	44	38cd-39ab	45	45	
24	Āry	22	22	24	23	44	39cd-40ab	46	46	
25	Āry	23	23	25	24	44	40cd-41ab	47	47	
E16	Āry	17	1	17	18	45	41cd-42ab	48	48	
E17	Āry	18	2	18	29	46	42cd-43ab	49	49	
E18	Āry	19	3	19	19	47	43cd-44ab	50	50	
E19	Upaj	20	4	20	20	48	44cd-45ab	51	51	
E20	Upag	21	5	21	21	49	45cd-46ab	52	52	
<b>5. kuṭṭaka</b>										
26	Śal	1	1	26	25	50	46cd-47ab	53	53	= L 242
27	Upaj	2	2	27	26	51	47cd-48b	54	54	= L 243
28	Upaj	3	3	28	27	51	48cd-49ab	55	55	= L 244
29	Upaj	4	4	29	28	51	49cd-50ab	56	56	= L 245

30	Upaj	5	5	30	29	52	50cd-51ab	57	57	= L 246
31	Drut	6	6	31	30	53	51cd-52ab	58	58	= L 248
32ab	Anu 1/2	7	7	32	31	54	53cd	60	59	= L 250
32cd	Anu 1/2	7	7	32	31	54	54ab	60	59	
32ef	Anu 1/2	8	8	32	31	55	52cd	59	60	= L 252
33ab	Anu 1/2	8	8	33	32	56	53ab	61	61	= L 252
33cd	Anu 1/2	9	9	33	32	56	54cd	61	61	= L 252
34ab	Anu 1/2	9	9	<34>	33	57	55ab	62	62	
34cd	Anu 1/2	10	10	<34>	33	57	55cd	62	62	
35ab	Anu 1/2	10	10	35	34	58	56ab	63	63	= L 254
35cd	Anu 1/2	11	11	35	34	58	56cd	63	63	= L 254
36ab	Upaj 1/2	11	11	36	35	59	57ab	64	64	= L 256
E21	Rath	1	1	22	22	60	57cd-58ab	65	65	= L 247
E22	Upaj	2	2	23	23	61	58cd-59ab	66	66	= L 249
E23	Rath	3	3	2<4>	24	62	59cd-60ab	67	67	≈ L 251
Q0	Anu	n.n.	n.n.	n.n.	∅	∅	∅	∅	∅	
Q1	Anu 1/2	n.n.	n.n.	n.n.	n.n.	n.n.	n.n.	n.n.	n.n.	= BG 32cd. 'mandāvabodhārtham mayoktam.'
E24	Anu	10	10	25	25	63	60cd-61ab	68	68	
E25	Anu	11	11	26	26	64	61cd-62ab	69	69	= L 253
E26	Rath	12	12"	26	27	65	62cd-63ab	70	70	= L 255
36cd	Upaj 1/2	13	10	36	35	66	63cd	71	71	= L 257
37ab	Upaj 1/2	14	11	37	35	66	64ab	71	71	= L 257
37cd	Upaj 1/2	14	11	37	36	67	64cd	72	72	= L 258
38	Upaj	15	12	38	37	67	65	72	72	= L 258
39	Upaj	16	13	39	38	68	66	73	73	= L 259
E27	Upaj	13	1	27	28	69	67	74	74	= L 260. J and F are available up to this verse.

BG	Meter	A	M	G	T	P	J	F	C	Notes
<b>6. varga-prakṛti</b>										
<b>6.1. varga-prakṛti</b>										
40	Śāl	1	1	40	39	70			75	
41	Śāl	2	2	41	40	71			76	
42	Śāl	3	3	42	41	71			77	
43	Śāl	4	4	43	42	71			78	
44	Anu	5	5	44	43	72			79	
45	Anu	6	6	45	44	73			80	
46ab	Anu 1/2	6	6	46	45	73			81	
E28	Anu	1	1	28	26	74			82	
<b>6.2. cakravāla</b>										
46cd	Anu 1/2	1	1	46	45	75			83	
47ab	Anu 1/2	1	1	47	46	75			83	
47cd	Anu 1/2	2	2	47	46	75			84	
48ab	Anu 1/2	2	2	48	47	75			84	
48cd	Anu 1/2	3	3	48	47	75			85	
49ab	Anu 1/2	3	3	49	48	75			85	
49cd	Anu 1/2	4	4	49	48	75			86	
50ab	Anu 1/2	4	4	50	49	75			86	
E29	Vas	1	1	29	30	76			87	
50cd	Anu 1/2	5	5	50	49	77			88	
51ab	Anu 1/2	5	5	51	50	78			88	
51cd	Anu 1/2	6	6	51	50	78			89	
52ab	Anu 1/2	6	6	52	51	78			89	

BG	Meter	A	M	G	T	P	J	F	C	Notes
E30	Anu	2	2	30	31	79			90	
E31	Anu	3	3	(31)	32	80			91	
52cd	Anu 1/2	7	7	52	51	81			92	
53ab	Anu 1/2	7	7	(53)	51	81			92	
53cd	Anu 1/2	8	7	(53)	52	82			93	
E32	Anu 1/2	4	4	n.n.	(33)	83			94	
54ab	Anu 1/2	8	8	54	53	84			95	
54cd	Anu 1/2	(9)	8	54	53	84			95	
E33ab	Anu 1/2	4	4	32	34	85			96	
E33cd	Anu 1/2	5	4	32	34	85			96	
E34ab	Anu 1/2	5	5	33	35	86			97	
E34cd	Anu 1/2	6	5	33	35	86			97	
E35ab	Anu 1/2	6	(6)	34	36	87			98	
E35cd	Anu 1/2	(7)	(6)	34	36	87			98	
55	Anu	(10)	(9)	55	54	88			99	
<b>7. ekavarṇa-samīkaraṇa</b>										
56	Śal	1	(1)	56	55	89			100	
57	Śal	2	2	57	56	89			101	
58	Śal	3	3	58	57	89			102	
E36	Upaj	1	1	35	37	90			103	
E37	Upaj	2	2	36	38	91			104	
E38	Śar	3	3	37	39	92			105	
E39	Śar	4	4	38	40	93			106	
E40	Śar	5	5	39	41	94			107	

BG	Meter	A	M	G	T	P	J	F	C	Notes
E41	Śār	6	6	40	42	95			108	= L 55
E42	Āry	7	7	n.n.	43	96			109	'anyoktam udāharanam.'
E43	Āry	8	8	41	44	97			110	
Q2	Anu	n.n.	n.n.	n.n.	∅	∅			n.n.	= GA, praśna 5
E44	Śār	9	9	42	45	98			111	= L 102
E45	Āry	10	10	43	46	99			112	
E46	Vas	11	11	44	47	100			113	
E47	Varnś	12	12	45	48	101			114	
E48	Śār	13	13	46	49	102			115	= L 99
E49	Anu	14	14	<47>	50	103			116	
E50	Anu	15	15	48	50	104			117	L 166 cited in E50p.
E51	Āry	16	16	49	52	105			118	
E52	Anu	17	17	50	53	106			119	
E53	Anu	18	18	51	54	107			120	
E54	Anu	19	19	<52>	55	108			121	
E55	Anu	20	20	53	56	109			122	
E56	Gīt	21	21	54	57	110			123	
E57	Māl	22	22	55	58	111			124	= L 150
E58	Mand	23	23	<56>	59	112			125	= L 155
E59	Śār	24	24	57	60	113			126	= L 157
E60	Gīt	25	25	58	61	114			127	= L 162
<b>8. ekavarṇa-madhyamāharaṇa</b>										
59	Indr	1	1	59	58	115			128	
60	Upaj	2	2	60	59	115			129	

BG	Meter	A	M	G	T	P	J	F	C	Notes
61	Upaj	3	3	61	60	115			130	
Q3	Upag/Udg	n.n.	n.n.	n.n.	n.n.	116			131	'śrīdharācāryasūtram.'
E61	Māl	1	1	62	62	117			132	= L 71
E62	Śār	2	2	(63)	63	118			133	= L 70
E63	Upaj	3	3	64	64	119			134	L121 cited in E63p.
E64	Anu	4	4	65	65	120			135	L 46ab cited in E64p1.
E65	Anu	5	5	66	66	121			136	
Q4	Āry 1/2	n.n.	n.n.	n.n.	0	0			0	= L 45cd
Q5	Āry	n.n.	n.n.	n.n.	0	0			0	= L 46
E66	Āry	6	6	67	67	122			137	
E67ab	Anu 1/2	7	7	68	68	123			138	
E67cdef	Anu	7	7	69	68	123			138	
E68	Upaj	8	8	70	69	124			139	
E69	Anu	9	9	71	70	125			140	
E70	Anu	10	10	72	71	125			141	
Q6	Anu	n.n.	n.n.	n.n.	0	0			142	'padmanābhajje.'
E71	Anu	11	11	73	72	126			143	
E72	Anu	12	12	74	73	126			144	
Q7	Anu	n.n.	n.n.	n.n.	n.n.	127			145	'ādyaparibhaṣa.'
E73	Anu	13	13	75	74	128			146	
62	Anu	14	14	64	61	129			147	
E74	Anu	15	15	76	75	130			148	L 56a cited in E74p.
63	Anu	16	16	65	62	131			149	
64	Anu	17	17	66	63	131			150	
E75	Anu	18	18	77	76	132			151	L 56a cited in E75p.

BG	Meter	A	M	G	T	P	J	F	C	Notes
E76	Anu	19	19	78	77	133			152	L 56a cited in E76p1.
<b>9. anekavarṇa-samīkaraṇa</b>										
65	Śāl	1	1	68	64	134			153	
66	Upaj	2	2	69	65	134			154	
67	Upaj	3	3	70	66	134			155	
68	Śāl 1/2	n.n.	n.n.	n.n.	n.n.	134			156	
Q8	Śār	1	1	n.n.	n.n.	135			n.n.	= BG E38 (only part of the 1st pāda is quoted)
Q9	Śār	2	2	n.n.	n.n.	136			n.n.	= BG E39 (only part of the 1st pāda is quoted)
E77	Śār	3	3	76	78	137			157	
E78	Anu	4	4	n.n.	79	138			158	
E79	Anu	5	5	n.n.	80	138			159	
E80	Āry	6	6	80	81	139			160	
E81	Āry	7	7	81	82	140			161	
E82	Anu	8	8	82	83	141			162	
E83	Śār	9	9	(83)	84	142			163	
E84	Anu	10	10	(84)	85	143			164	
E85	Anu	11	11	85	86	144			165	
E86	Anu	12	12	86	87	145			166	
69	Anu	n.n.	n.n.	n.n.	1	146			167	
E87	Anu	13	13	n.n.	88	147			168	
Q10	Anu	n.n.	n.n.	n.n.	0	0			169	'tathā coktam.'
E88	Anu 3/2	14	14	n.n.	89	148			170	'adyodāharaṇam.'
Q11	Āry	0	n.n.	n.n.	0	0			n.n.	'tathā coktam.'



BG	Meter	A	M	G	T	P	J	F	C	Notes
<b>10. anekavarṇa-madhyamāharaṇa</b>										
70	Śāl 1/2	1	1	68	67	149			171	
71ab	Upaj 1/2	1	1	69	68	149			172	
71cd	Upaj 1/2	2	2	69	68	149			172	
72ab	Upaj 1/2	2	2	70	69	149			173	
72cd	Upaj 1/2	3	3	70	69	149			173	
73	Vas	3	3	71	70	150			174	
74	Upaj	4	4	72	71	151			175	
75	Simh	5	5	73	72	151			176	
E89	Anu	1	1	88	70	152			177	
E90	Anu	2	2	n.n.	71	153			178	'adyodāharaṇam.'
76	Upaj	6	6	74	73	154			179	
77ab	Upaj 1/2	(7)	(7)	(75)	(74)	154			180	
E91	Anu	1	1	89	72	155			181	
E92	Anu	2	2	90	73	156			182	
77cd	Upaj 1/2	7	(7)	75	74	157			183	
78	Upaj	8	8	76	75	157			183	
E93	Anu	1	1	91	74	158			184	
79	Upaj	9	9	77	75	159			185	
80	Upaj	10	10	78	77	162			186	
E94	Anu	1	1	92	75	160			187	
E95	Anu	2	2	90	76	161			188	
E96	Anu	3	3	91	97	163			189	
E97	Śar	5	5	n.n.	98	164			190	'kasyāpy udāharaṇam.'
81	Anu	n.n.	n.n.	70	78	165			n.n.	

BG	Meter	A	M	G	T	P	J	F	C	Notes
82	Upaj	11	11	83	79	166			191	
83	Indr	12	12	84	80	166			192	
E98	Śār	6	6	95	99	167			193	
E99	Āry	4	4*	n.n.	100	168			194	'ādyodāharanam.' L 58a cited in E99p3.
84	Anu	13	13	n.n.	81	169			195	
85	Anu	14	14	83	82	169			196	
E100	Anu	1	1	96	101	170			197	
E101	Anu	2	2	n.n.	102	171			198	'ādyodāharanam.'
E102	Anu	3	3	97	103	172			199	
86	Anu	n.n.	n.n.	84	83	173			200	
87	Anu	15	15	85	84	174			201	
87ref	Anu 1/2	n.n.	n.n.	n.n.	n.n.	174			201	
E103	Anu	1	1	(98)	104	175			202	
88	Āry	16	16	n.n.	85	176			203	'pūrvair upāyaḥ paṭhitah.'
89	Gīt	17	17	n.n.	86	177			204	cont.
90	Gīt	18	18	n.n.	87	178			205	cont.
E104	Anu	2	2	99	105	179			206	
E105	Anu	3	3	100	106	180			207	
<b>11. bhāvita</b>										
91	Upaj	1	1	86	88	181			208	
E106	Anu	1	1	(101)	107	182			209	
E107	Anu	2	2	(102)	108	183			210	
E108	Śār	4	4	103	109	184			211	
92ab	Anu 1/2	2	2	88	89	185			212	

BG	Meter	A	M	G	T	P	J	F	C	Notes
92cd	Anu 1/2	2	2	88	89	185			213	
92ef	Anu 1/2	3	3	88	90	185			213	
93ab	Anu 1/2	3	3	89	90	185			214	
93cd	Anu 1/2	n.n.	n.n.	89	91	185			214	
Q12	Anu	n.n.	n.n.	n.n.	n.n.	n.n.			n.n.	= BG E106. T(K) and P(K) cite E106a.
94	Anu	n.n.	n.n.	90	∅	∅			n.n.	
E109	Anu	1	1	n.n.	110	186			215	
E110	Anu	2	2	n.n.	111	187			216	
Q13	Śār 1/2	n.n.	n.n.	n.n.	n.n.	n.n.			n.n.	= BG E108ab. T(K) and P(K) cite part of E108a.
Q14	Śār 1/4	n.n.	n.n.	n.n.	∅	∅			n.n.	= BG E108c
<b>12. grantha-samāpti</b>										
95	Vas	n.n.	n.n.	91	92	1			217	
96	Indr	n.n.	n.n.	92	93	2			218	
97ab	Anu 1/2	n.n.	n.n.	93	94	3			219	
97cd	Anu 1/2	n.n.	n.n.	93	94	4			219	
98ab	Anu 1/2	n.n.	n.n.	(94)	95	4			220	
98cd	Anu 1/2	n.n.	n.n.	(94)	95	5			220	
99	Anu	n.n.	n.n.	(95)	96	6			221	
100	Anu	n.n.	n.n.	96	97	7			222	
101	Anu	n.n.	n.n.	(97)	98	8			223	= CV 14.5
Q15	Anu	n.n.	n.n.	∅	∅	∅			224	= GA, praśna 3
102	Māl	n.n.	n.n.	98	99	9			225	